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SUPPLEMENT 145

STUDIES ON VEGETABLE SEED TREATMENTS IN 1943

March 15, 1944

The Plant Disease Reporter is issued as a service to plant pathologists throughout the United States. It contains reports, summaries, observations, and comments submitted voluntarily by qualified observers. These reports often are in the form of suggestions, queries, and opinions, frequently purely tentative, offered for consideration or discussion rather than as matters of established fact. In accepting and publishing this material the Division of Mycology and Disease Survey serves merely as an informational clearing house. It does not assume responsibility for the subject matter.

STUDIES ON VEGETABLE SEED TREATMENTS IN 1943

Plant Disease Reporter
Supplement 145 March 15, 1944

This series of articles constitute the 1943 report of the Vegetable Seed Treatment Subcommittee of the Seed Treatment Committee to the American Phytopathological Society. The reports by Drs. Koehler and Semeniuk report work done independently of the vegetable committee but are included herein for the convenience of the readers in assembling the various reports.

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I. SCOPE OF THE 1943 TESTS

George L. McNew

Series of uniform seed treatment tests were made with 13 vegetable crops during 1943. A total of 233 sets of seed were distributed to 60 cooperators in 34 States, and in 2 Provinces of Canada, as shown in Table 1. Each set consisted of 5 replications of 100 seeds each from various treated lots prepared by the crop leaders. All the seed of each crop was from the same stock except for potatoes and sweetpotatoes, of which each cooperator treated his own stock according to standard procedures.

The tests were set out according to a fixed plan at the appropriate date in each locality, and the data were subjected to analysis of variance according to the same procedure; so the variations in results reported are mainly attributable to differences in environmental conditions. The reports offer considerable data on the severity of seed decay and damping-off in different localities, the value of different fungicides, and the minimum effective dosages that can be employed under different environmental conditions.

Considerable emphasis was placed on the rate of application because the use of different dosages is a preferred method of evaluating fungicides. Furthermore, the information obtained can be of great service in making effective use of existing supplies of fungicides. In all reports, the rate of application has been expressed as percentage by weight. This was considered necessary to avoid the confusion and misinterpretaion that has developed from using different standards such as those in vogue (percentages, oz. per 15 lb., or oz. per bushel). The bushel measure is so variable that it particularly is to be condemned and should be discarded in expressing rates. Where confusion is likely to result from use of percentages, the rate in ounces per bushel has been put in parentheses at some point in each report.

Number of Cooperative Seed Treatment Trials Made During 1943
Table 1

Test to be made No.	State	Name of cooperators	Number of Tests on Crops[a] A	B	C	D	E	F	G	H	I	J	K	L	M	Total
01	Cal.	L. D. Leach		1	1		1	1	1							5
02	Conn.	J. G. Horsfall & A. D. McDonnell	1	1			1									3
03	Conn.	A. M. Porter					1									1
04	Del.	J. W. Heuberger			1											1
05	Del.	S. L. Hopperstead					1									1
06	Fla.	A. L. Harrison	1	1	1		1		1			1				6
07	Fla.	A. N. Brooks					1									1
08	Fla.	G. W. Townsend			1											1
09	Fla.	W. B. Tisdale					1									1
10	Ga.	W. D. Moore		1	1		1	1		1						5
11	Ga.	G. E. Thompson				1	1		1			1				4
12	Idaho	G. Ken Knight		1			1					1				3
13	Ill.	M. B. Linn	1	1	1		1	1	1	1	1		1			9
14	Ind.	R. M. Caldwell				1										1
15	Ind.	R. W. Sampson									2					2
16	Ind.	G. M. Smith and A. J. Ullstrup	1													1
17	Iowa	R. H. Porter and W. N. Rice	1	2	2	1	1	1		1			2			11
18	Maine	Reiner Bonde		1												1
19	Maine	Reiner Bonde and R. M. Bailey	2													2
20	Md.	C. E. Cox					1									1
20.1	Md.	S. P. Doolittle and F. S. Beecher							2				2			4
21	Mass.	O. C. Boyd and Thos. Sproston									1					1
22	Mass.	E. F. Guba and O. C. Boyd	1	1	1		1	1				1		1		7
23	Mass.	C. V. Kightlinger									1					1
24	Mich.	J. H. Muncie		1		1	1	1	1	1			1			7
25	Minn.	R. S. Davidson and C. J. Eide									3					3

[a] Crops tested:

A. Sweet corn
B. Peas
C. Lima Beans
D. Soybeans
E. Spinach
F. Beets
G. Tomatoes
H. Onion
I. Potato
J. Snap beans
K. Cucumber
L. Sweetpotato
M. Carrot

No.	State	Name of cooperators	A	B	C	D	E	F	G	H	I	J	K	L	M	Total
26	Minn.	C. J. Eide	1	1	1		1									4
27	Minn.	I. W. Tervet				1										1
28	Miss.	J. A. Pinckard	3	3	3		1				2	3				15
29	Mo.	C. M. Tucker				1										1
30	Neb.	J. E. Livingston and M. W. Felton	1	1							1					3
31	N. J.	C. M. Haenseler	1	1	1		1						1			5
32	N. Y.	H. H. Campbell					1									1
33	N. Y.	H. S. Cunningham	1	1	1		1									4
34	N. Y.	A. A. Foster	1	1	1	1	1	1	1							7
35	N. Y.	F. M. Gordon	1		1		1		1							4
36	N. Y.	G. L. McNew	2	3	2	1	2	1	2	1	1	1	1		2	19
37	N. Y.	A. G. Newhall								1						1
38	N. C.	D. E. Ellis					1									1
39	N. D.	W. E. Brentzel					1									1
40	Ohio	J. D. Wilson	1	2	1	1	1	1								7
41	Okla.	J. H. McLaughlin	1		1		1									3
42	Okla.	J. H. McLaughlin and H. B. Cordner									1					1
43	Okla.	J. H. McLaughlin and H. Graumann				1										1
44	Pa.	W. S. Beach	1	1	1	1	1	1	1			1	1			9
45	R. I.	F. L. Howard	1			1	1				1					4
46	S. C.	C. N. Clayton	1	1	1	1	1				1					6
47	S. C.	C. J. Nusbaum	1	1	1	1	1					1		1		7
48	S. D.	W. F. Buchholtz	1	1			1	1								4
49	Tenn.	C. D. Sherbakoff and R. A. Hyre	1			1	1									3
50	Tex.	G. H. Godfrey					1									1
51	Va.	R. P. Porter		1	1	1	1					2		1		7
52	Wash.	C. J. Gould	1	1	1		1	1	1	1		1				8
53	Wash.	C. J. Gould and T. E. Randall									1					1
54	Wash.	L. K. Jones	1	1		1		1	1							5
55	W. Va.	J. G. Leach	1		1	1	1									4
56	Wis.	J. G. Dickson	1			1										2
57	Wis.	J. C. Walker		1	1		1			1		1				5
58	Wyo.	G. H. Starr	1	1	1		1				1					5
59	Canada	Irene Mounce and J. E. Bosher					1			1						2
60	Canada	G. A. Scott		1			1									2
		Total Number	32	34	29	19	42	13	14	10	16	14	9	2	3	237

The fungicides tested on one or more crops were:

Arasan (50% tetramethyl-thiuram-disulfide manufactured by the Bayer-duPont Company)
Bichloride of mercury (mercuric chloride, corrosive sublimate)
Borax (sodium tetraborate manufactured by the Pacific Coast Borax Company)
Catex (an impure phenol secured by the destructive distillation of pine wood by the Southern Pine Chemical Company)
New Improved Ceresan (5% ethyl mercury phosphate manufactured by Bayer-duPont Company)
2% Ceresan (2% ethyl mercury chloride manufactured by the Bayer-duPont Company)
Copper sulfate (blue vitriol crystals with 25% copper equivalent)
Fermate (70% ferric dimethyl-dithio-carbamate manufactured by the Grasselli Chemical Division of E. I. duPont Company)
Formaldehyde-40% solution
Semesan (30% hydroxymercurichlorophenol manufactured by the Bayer-duPont Company)
Semesan Jr. (1% ethyl mercury phosphate manufactured by the Bayer-duPont Company)
Semesan Bel (12% hydroxymercurinitrophenol and 2% hydroxymercurichlorophenol manufactured by the Bayer-duPont Company)
Spergon (98% tetrachloro-para-benzoquinone manufactured by the U. S. Rubber Company)
Thiosan (same as Arasan except for incorporation of a wetting agent)
Yellow cuprocide (83% yellow cuprous oxide manufactured by the Rohm and Haas Company)
Yellow oxide of mercury (mercuric oxide)
Zinc oxide (AAZ special manufactured by Rohm and Haas or Vasco 4 by Virginia Smelting Company).

Several new lines of study were undertaken by the Committee in 1943. Preliminary tests on seed disinfectants were initiated. Seed treatments as substitutes for soil disinfestants, such as formaldehyde for controlling onion smut, have been so promising that they were placed in the cooperative tests. The critical studies on the value of potato seed-piece treatment were continued another year to determine if they were of dubious value as indicated by the 1942 tests. Preliminary studies were begun with fungicides for soybean seed. Considerable effort was devoted to a study of the possibility of securing pre-treatment of vegetable seed by seedsmen before distribution to the growers. Since this latter activity is more of an extension function than research, its activities were later incorporated into the program of the Fungicide Sub-committee of the War Committee, but it may well be included in this report since it is largely based on the research activities of the Vegetable Seed Treatment Committee.

It is hoped that members of the American Phytopathological Society and their fellow scientists can make use of this report in meeting war-time conditions. If occasion demands citation of the data, due credit should be given to the appropriate crop leader for preparation of summaries and to the particular cooperators who collected specific data and made these

studies possible. The leaders responsible for the different reports are as follows: sweet corn, C. M. Haenseler; peas, George L. McNew; lima and snap beans, J. C. Walker; soybeans, R. H. Porter; spinach, R. P. Porter; beets, L. D. Leach; tomatoes and cucumbers, S. P. Doolittle; onions, A. G. Newhall; potato, C. N. Clayton; sweetpotato, C. J. Nusbaum; and contact with seedsmen, R. H. Porter and W. F. Crosier.

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II. SWEET CORN SEED TREATMENTS

C. M. Haenseler

Emergence data were obtained in 31 standardized tests conducted in 31 localities in 23 States on a commercial lot of Golden Cross Bantam sweet corn agitated for 15 minutes with different chemicals. The treatments applied were Semesan Jr. at 0.1875% by weight; Arasan at 0.0937%, 0.1875%, and 0.3750%; and Spergon at 0.0937%, 0.1875%, and 0.375%.

A total of 500 seeds of each of these treated lots and an untreated check were planted in 5 randomized replications of 100 seeds each. Counts were taken on total number of seedlings emerged. Records on the number of weak seedlings was obtained in 13 of the 31 tests.

All tests were made under field conditions. A record of the environmental conditions prevailing in each test is given in Table 2. Data on seedling emergence and the statistical significance of these data are recorded in Table 3.

The number of tests in which seedling emergence for one treatment was significantly better than for each other treatment, and the relative value of the several treatments are presented in Table 4.

In eighteen (58%) of the 31 tests conducted in 1943, the total emergence counts showed statistically significant differences (at 5% level) between treatments when the data were analyzed by Fisher's method for the analysis of variance for a randomized block experiment. Based on analysis of these 18 significant tests the results may be summarized as follows:

1. Treated seed gave significantly higher germination rates in all except 2 out of a total of 126 possible comparisons.

2. Arasan and Spergon gave significant increases in germination in a larger number of cases than did Semesan Jr. used at the same dosage.

3. In each of 3 dosages used, Arasan gave increased germination somewhat more frequently than did Spergon.

4. Both Arasan and Spergon gave progressively better seed protection as the dosage rates were increased from .0937% to .187% and to .375%.

5. "Weak seedling" counts made in 13 tests showed the largest total number of weak seedlings from untreated seed, and the lowest number in the .375% Arasan treatment which gave the highest total emergence. Thus the largest number of weak seedlings occurred where the total germination was poorest and vice versa. This would indicate definitely that greater benefits may be derived from seed treatments than are shown in the "total emergence" figures ordinarily used in evaluating seed protectants.

6. Yields were obtained in only one test. In this test .375% Arasan-

Table 2. Location, time, and environmental conditions for 31 cooperative sweet corn tests conducted in 1943.

Report from Test no.	State	Planting date	Soil condition pH	Moisture	Soil type	Germ. period[b] Rainfall	Air temp. °F. Min.	Max.	Days to emerge[a]
						In.			
13	Ill.	5/14	7.2	Opt.	Clay loam	3.92	49	63	11
16	Ind.	4/19	--	Dry	Sandy	1.43	44	65	16
17-1	Iowa	4/16	7.0	Opt.	Clay loam	--	--		--
19-2	Maine	5/28	6.0	Wet	Loam	1.86	44	66	--
22	Mass.	5/4	6.0	Wet	Sandy loam	2.42	46	69	13
28-2	Miss.	4/2	6.7	Wet	F. sandy loam	.75	56	81	6
30	Neb.	5/5	5.6	V.wet	Clay loam	2.66	44	62	11
31	N.J.	7/16	5.0	Opt.	Loam	.13	65	88	5
35	N.Y.	5/10	--	Dry	Sandy loam	4.59	54	66	14
36-2	N.Y.	6/29	7.0	Opt.	Silt loam	1.63	60	83	--
44	Pa.	6/4	6.8	Dry	Clay loam	.55	61	80	7
46	S.C.	3/16	5.0	Opt.	Sandy loam	2.10	47	70	9
48	S.D.	5/6	6.5	Opt.	Sandy loam	1.98	43	68	19
49	Tenn.	4/29	5.6	Opt.	Silt loam	1.21	56	81	8
52	Wash.	5/27	5.7	Opt.	Sandy loam	1.07	43	68	--
54	Wash.	5/7	7.2	Wet	Loam	.72	39	59	--
55	W.Va.	5/26	7.4	Wet	Clay loam	Note[c]	70	78[c]	8
58	Wyo.	5/4	7.5	Opt.	Sandy loam	.72	38	53	23
2	Conn.	3/16	5.2	Wet	F. sandy loam	W. daily	54	80	7
6	Fla.	3/10	7.0	Opt.	F. loamy sand	.00	56	80	8
19-1	Maine	6/6	6.5	Opt.	F. sandy loam	1.26	49	75	14
26	Minn.	5/3	5.7	Dry	Silt loam	2.34	39	63	17
28-1	Miss.	4/12	5.7	Opt.	Ochlockonee	.07	54	79	8
28-3	Miss.	4/6	--	Dry	Silt loam	.04	55	73	13
33	N.Y.	5/28	5.1	Opt.	Loam	1.58	59	81	5
36-1	N.Y.	6/15	7.0	Opt.	Silt loam	1.74	63	88	--
40	Ohio	5/14	6.5	Opt.	Silt loam	2.27	49	67	--
41	Okla.	4/7	6.8	Dry	Loam	1.08	48	73	10
45	R.I.	5/13	6.2	Wet	V.F.Fine	1.32	45	65	9
47	S.C.	4/26	5.5	Opt.	Sandy loam	.17	57	82	7
56	Wis.	5/28	--	Opt.	Silt loam	1.13	58	72	10

a -- "Days to emerge" was taken as time between planting and time when majority of seedlings emerged.

b -- For sake of uniformity in recording precipitation and temperatures, the germination period was arbitrarily considered as 50% longer than "days to emerge".

c -- Two heavy rains during germination period. Temperature data on last half of germination period only.

Table 3. Summary of cooperative sweet corn seed treatment tests analyzed as randomized block tests -- 1943

Report from test no.	State	Average number of seedlings emerged from							Diff. req. sign.	Calc. "F" value
		Semesan Jr. used at	Arasan used at			Spergon used at				
		.1875 %	.0937 %	.1875 %	.375% %	.0937 %	.1875 %	.375% %		
13	Ill.	63.2	69.2	66.8	73.0	70.6	68.4	72.0	52.2	7.10	7.47
16	Ind.	85.0	87.8	91.2	93.6	86.4	90.4	90.4	79.8	5.35	5.59
17-1	Iowa	81.0	85.8	84.0	84.2	82.4	80.0	86.4	77.4	4.65	3.65
19-2	Maine	83.4	84.8	89.2	83.8	85.8	86.0	84.4	78.2	5.03	3.19
24	Mass.	86.6	90.6	91.2	89.0	86.6	87.8	85.6	85.2	4.16	2.44
28-2	Miss.	75.6	81.4	70.8	75.0	75.8	77.4	80.0	68.8	7.78	2.49
30	Neb.	47.4	57.6	56.0	65.6	49.2	61.2	56.4	37.6	10.12	6.11
31	N.J.	83.0	81.8	80.6	82.8	83.8	83.6	85.8	77.2	4.94	2.62
35	N.Y.	73.6	78.4	82.4	79.8	79.8	76.6	80.4	65.6	7.52	4.24
36-2	N.Y.	86.6	87.8	86.8	85.4	81.2	82.6	82.8	79.0	5.16	3.03
44	Pa.	88.0	85.2	85.4	85.6	86.6	87.0	87.0	79.8	4.35	2.82
46	S.C.	74.8	84.0	86.6	87.2	83.0	79.6	83.4	80.0	5.80	4.14
48	S.D.	87.0	82.4	85.0	89.6	80.0	81.2	84.4	85.0	5.32	2.79
49	Tenn.	80.4	77.4	85.6	87.2	77.6	83.0	85.2	77.2	5.78	4.21
52	Wash.	80.8	77.0	71.4	66.8	82.0	86.4	83.6	80.8	9.37	4.11
54	Wash.	68.0	71.8	76.0	76.6	73.8	73.4	75.2	50.0	7.33	11.98
55	W.Va.	79.6	82.8	84.8	85.8	77.2	79.6	76.0	74.8	6.60	3.18
58	Wyo.	36.0	29.6	35.8	39.2	30.6	35.8	39.6	25.2	7.65	3.62
2	Conn.	84.8	88.0	89.2	90.8	86.4	87.0	88.4	82.4	N.S.	1.48
6	Fla.	84.4	83.0	80.0	80.4	79.4	79.8	79.2	75.6	N.S.	2.32
19-1	Maine	75.4	79.6	83.0	82.4	79.4	83.6	81.2	75.8	N.S.	1.85
26	Minn.	69.2	72.6	68.6	76.0	73.6	67.6	76.4	66.0	N.S.	2.35
28-1	Miss.	57.8	64.0	68.2	71.4	62.2	60.4	63.2	66.6	N.S.	1.36
28-3	Miss.	78.6	71.8	79.4	78.0	81.6	80.4	79.6	74.6	N.S.	1.16
33	N.M.	89.2	88.4	91.6	93.2	91.4	87.8	91.0	86.6	N.S.	2.27
36-1	N.Y.	67.6	73.0	72.2	70.0	67.2	71.4	67.4	61.8	N.S.	1.61
40	Ohio	86.4	85.2	86.8	84.4	86.4	85.6	86.8	86.0	N.S.	0.38
41	Okla.	82.2	83.4	81.6	82.4	80.8	81.4	79.2	77.4	N.S.	0.74
45	R.I.	79.8	82.8	82.4	81.4	80.6	80.0	80.4	75.6	N.S.	0.80
47	S.C.	66.2	73.2	71.0	71.4	66.0	67.2	69.6	71.0	N.S.	0.74
56	Wis.	82.4	86.6	84.2	84.4	84.0	86.0	85.8	86.8	N.S.	0.67

Table 4. Number of tests in which seedling emergence for one treatment was significantly better than that for each other treatment in 18 of the 31 tests (Maximum score = 126)

Column 1	Number of times treatment in Column 1 was better than: Semesan Jr. .1875%	Arasan used at .0937%	Arasan used at .1875%	Arasan used at .375%	Spergon used at .0937%	Spergon used at .1875%	Spergon used at .375%	Untreated check	Score of treatment
Semesan Jr. .1875%	---	0	0	1	2	1	0	8	12
Arasan .0937%	3	---	1	1	1	2	2	12	22
Arasan .1875%	5	2	---	1	4	1	2	14	29
Arasan .375%	6	4	0	---	6	2	1	14	33
Spergon .0937%	2	0	1	1	---	0	0	9	13
Spergon .1875%	2	1	1	1	1	---	0	11	17
Spergon .375%	4	2	3	1	2	1	---	12	25
Untreated check	0	0	1	1	0	0	0	---	2

treated seed gave highest germination and highest yield, and all of the treatments except Semesan Jr. gave significantly higher yields than did the untreated seed.

7. In one test where height of plants at tassel time was taken, no significant difference in average plant height was shown as a result of the seed treatments.

III. PEA SEED TREATMENTS

George L. McNew

Sufficient pea seed of the variety Thos. Laxton was treated to provide 5 replications of 100 seeds from each treatment for 32 tests by 28 co-operators in 23 States and in 2 Provinces of Canada. The seed was treated by rotation in a half-filled glass container on a vertical turntable for 15 minutes with Spergon, Arasan, or Fermate at 0.34% (3 ounces per bushel), 0.17%, and 0.08% by weight. These 9 treatments and an untreated control were used in all tests.

Two orientation tests were made under greenhouse conditions: one in steamed soil and another in steamed soil artifically infested with Pythium ultimum. Emergence records were taken 38 days after the seed was sown. At that time the plants were cut off at the ground line, dried to constant weight at 105°C., and weighed. Records on the amount of chemical applied to the seed and the results of these 2 tests are given in Table 5.

Table 5. Effect of seed treatments on the emergence and growth of peas in steamed and Pythium-infested soil[a]

Treatment applied to seed: Material	Rate	Weight of materials: Untr. seed	Chemical[b]	Treated seed	Emergence in: Steamed soil	Infested soil	Dry wt. plants: Steamed soil	Infested soil
	%	Gm.	Gm.	Gm.	%	%	Gm.	Gm.
Spergon	.335	4500.1	15.08	4514.2	98.0	95.2	18.12	17.44
Spergon	.168	4500.0	7.54	4507.3	97.8	96.8	17.26	16.46
Spergon	.084	4500.1	3.78	4504.1	97.4	94.2	17.48	16.50
Arasan	.335	4500.0	15.08	4515.1	98.2	87.2	16.64	16.26
Arasan	.168	4500.1	7.54	4507.0	96.6	91.4	17.22	15.08
Arasan	.084	4500.0	3.78	4503.5	97.4	94.8	15.92	16.70
Fermate	.335	4500.0	15.08	4514.2	97.6	90.4	16.02	16.06
Fermate	.168	4500.1	7.54	4506.5	96.8	87.6	16.76	14.02
Fermate	.084	4500.0	3.78	4503.8	97.2	89.8	16.54	15.24
None	---	4500.0	---	4499.6	96.4	78.6	16.20	13.14
Sign. Diff. at 5% Point					N.S.	3.0	N.S.	.55

[a] These 2 tests are referred to as 36a and 36b in subsequent tables.
[b] A slight excess over calculated amount was used in order to secure full dosages.

Apparently none of the treatments injured the seed appreciably since about 97% emergence was secured from all lots sown in steamed (disease-free) soil. There was no significant difference in the average dry weight of plants in steamed soil, but there was definite indication that all 3 Spergon-treated lots produced heavier plants. In Pythium-infested soil, all 9 treatments produced significant increases in emergence and yield of dry plant tissue. The materials rated in the order Spergon, Arasan, and Fermate. There was no significant dosage response even though Fermate appeared slightly less effective at the lower dosages.

The seed lots distributed to cooperators were sown in randomized blocks under a variety of field conditions as shown in Table 6. The conditions were typical of the locality in all except 2 or 3 tests where seed were sown in greenhouses or watered. In all other tests the seed was sown at the usual planting date under ordinary circumstances.

Emergence varied widely in the different localities with untreated seed producing between 8.0 and 90.6% of a stand. One or more treatments produced a significant increase in emergence in 22 (69%) of the 32 tests as shown by the records in Table 7. On the average of all tests, emergence was increased from 71% in the checks to 86% in the better treatments. The average emergence in the 22 tests with significant differences was only slightly less for the better treatments, but the untreated controls had dropped to 65.6% emergence.

A comparison of the various tests show wide variations in results, but the general averages for the 9 treatments agree very closely with the results obtained in the orientation tests. Very few of the field tests showed definite dosage response curves, but in 1 or 2 instances where seed decay was severe (test 02) the heavier applications were definitely superior. Spergon appeared to be more effective than the 2 organic sulfur compounds since it produced an average emergence in the significant tests that was 1 to 4% better than Arasan and 6 to 8% better than Fermate. The relative value of the various treatments perhaps can best be summarized by the number of times that they were reported significantly better than some other treatment or the controls. Such data, abstracted from Table 7, have been summarized in Table 8. The margin of safety for these 3 organic treatments is amply attested by the failure of the untreated seed to score on any of the treated lots in any of the 22 tests used in compiling Table 8. On the other hand, the treated lots produced significant improvement in 160 instances. Spergon's margin of superiority when used at 0.35% (3 oz. bu.) and 0.17% (1.5 oz.) is definitely shown by the scores of 69 and 68 as compared to 63 for Arasan at 0.35% and 31 for Fermate at 0.35%. A more critical comparison probably could be obtained from examining the number of times some other treatment excelled them by a significant margin. As shown in the bottom line of Table 8, Spergon at the 2 higher dosages was scored upon only 3 and 2 times, respectively.

There would seem to be little practical advantage in using more than 0.17% of Spergon (1.5 oz./bu.) by weight since the benefits from heavier rates under average conditions would not justify the additional expense. Under some conditions (tests 02, 51), however, the heavier application is worthwhile. The heavier doses of Arasan and Fermate seem to be warranted under average conditions. As a matter of fact, heavier rates for Fermate were quite essential in many tests.

Table 6. Location, time, and envoronmental conditions for 32 cooperative pea seed treatment tests conducted in 1943

Report from Test no.	State	Planting date	Soil conditions at planting time: Soil type	pH	Moisture	Rainfall	Air temperature: Max. °F.	Min. °F.	Days to emerge
						In.			
01	Calif.	2/16	Sandy loam	7.1	Opt.	0.60	66	44	--
02	Conn.	3/30	Fine sandy loam	5.2	Wet	Water	86	61	6
06	Fla.	1/29	Sandy loam	6.5	Opt.	---	79	55	8-10
10	Ga.	2/1	Sandy loam	5.2	Opt.	1.00	70	43	12
12	Idaho	5/21	Sandy loam	6.9	Opt.	0.05	66	44	9-12
13	Ill.	5/13	Clay loam	6.2	Opt.	2.55	57	46	6
17a	Iowa	4/8	Clay loam	--	Opt.	---	--	--	12
17b	Iowa	--	Silt loam	---	Moist	Water	50	--	--
22	Mass.	4/28	Grav.S. loam	5.9	Wet	3.07	64	40	15
24	Mich.	5/7	Sandy loam	--	---	2.94	61	43	--
26	Minn.	4/23	Silt loam	5.7	Opt.	0.83	60	38	20
28a	Miss.	2/24	Fine sandy loam	6.7	---	4.25	57	34	19
28b	Miss.[a]	2/13	Silt loam	5.4	Opt.	0.77	60	39	12-14
30	Nebr.	4/2	Clay loam	7.2	---	1.03	66	41	14
31	N.J.	7/16	Loam	5.6	Opt.	0.09	88	66	8
33	N.Y.	3/27	Loam	5.1	Opt.	2.56	49	33	26
34	N.Y.	4/24	Sandy loam	6.5	Wet	0.21	63	45	11
36a	N.Y.	1/27	Sterile compost	6.8	Opt.	Water	75	60	9
36b	N.Y.	1/20	Infested compost	6.9	Opt.	Water	75	60	9
40a	Ohio	4/29	Muck	5.5	Opt.	1.42	65	50	11
40b	Ohio	4/24	Silt loam	6.5	Wet	0.93	60	36	11
40.1	Oregon	3/9	Clay loam	6.0	Wet	0.45	55	35	15
44	Pa.	4/27	Clay loam	6.9	---	0.61	55	38	8
46	S.C.	1/27	Sandy loam	5.1	Opt.	2.59	63	40	16
47	S.C.	3/11	Sandy loam	5.8	Opt.	0.11	74	52	6
48	S.D.	4/24	Sandy loam	6.5	Dry	0.94	65	38	30
51	Va.	3/2	Sandy loam	5.8	Opt.	1.99	59	37	18
52	Wash.	4/24	Sandy loam	6.0	Opt.	0.50	64	36	--
54	Wash.	5/5	Loam	7.2	Opt.	0.95	55	37	16
57	Wis.	4/21	Silt loam	6.5	Opt.	0.99	65	44	14
58	Wyo.	4/29	Sandy loam	7.5	---	0.72	54	38	26
60	Canada	6/10	Sandy loam	7.5	Opt.	1.27	75	53	6

a -- 28b test made by H. H. Foster; 40.1 test made by P. W. Miller and F. P. McWhorter

Table 7. Effect of seed treatments on emergence of Thos. Laxton peas
(table concluded on next page)

Report from Test no.	Locality	Emergence from seed treated with Spergon at rate of .335%	.168%	.084%	Arasan at rate of .335%	.168%	.084%
		%	%	%	%	%	%
01	Calif.	87.4	87.2	85.2	86.2	82.0	85.0
02	Conn.	80.0	66.8	61.2	72.4	56.4	49.4
06	Fla.	88.4	89.0	89.2	72.4	79.0	68.4
10	Ga.	72.8	71.6	71.8	70.8	64.6	73.6
13	Ill.	91.2	96.0	94.6	93.4	93.2	94.8
17a	Iowa	83.2	90.6	91.2	89.0	85.8	93.4
17b	Iowa	91.0	90.8	74.0	91.2	84.5	75.2
22	Mass.	90.2	93.6	88.2	93.4	93.8	90.2
24	Mich.	83.2	84.8	82.6	81.2	79.4	80.2
26	Minn.	91.2	92.8	93.4	95.8	92.0	88.8
31	N.J.	76.4	70.8	79.0	76.0	58.4	80.2
33	N.Y.	83.6	81.6	82.6	85.0	80.8	79.4
34	N.Y.	85.4	83.6	78.0	84.0	82.6	80.6
36b	N.Y.	95.2	96.8	94.2	87.2	91.4	94.8
40a	Ohio	87.6	83.2	81.8	86.8	77.8	77.2
40b	Ohio	89.2	88.6	91.0	91.8	88.4	87.0
40.1	Oreg.	81.2	87.6	86.0	89.6	87.6	86.8
44	Pa.	92.8	91.8	90.2	91.4	91.4	89.8
51	Va.	71.8	67.2	62.8	53.2	45.0	39.4
52	Wash.	83.2	85.2	78.2	78.8	77.6	75.8
54	Wash.	90.4	87.4	90.2	89.4	89.2	89.6
57	Wis.	84.2	82.2	82.6	90.0	82.0	83.4
Av. (Sign.)		85.4	85.0	83.1	84.0	80.1	80.1
12	Idaho	84.4	87.2	84.8	88.0	83.4	86.8
28a	Miss.	75.0	66.8	75.8	69.6	65.8	63.6
28b	Miss.	91.0	91.2	86.2	89.2	90.6	88.6
30	Nebr.	83.2	89.6	91.0	93.2	92.0	88.2
36a	N.Y.	98.0	97.8	97.4	98.2	96.6	97.4
46	S.C.	87.6	82.0	82.4	85.4	74.4	84.4
47	S.C.	94.6	95.6	95.8	94.8	97.2	95.0
48	S.D.	79.2	79.4	78.2	82.8	81.4	83.6
58	Wyo.	91.8	91.4	90.4	97.6	91.2	92.8
60	Canada	95.0	94.5	92.5	90.0	93.0	89.0
Av. (Not sign.)		88.0	87.6	87.4	88.9	86.6	86.9
GRAND AV.		86.2	85.8	84.0	85.6	82.1	82.3

Table 7. Effect of seed treatments on emergence of Thos. Laxton peas. (Concluded from preceding page)

Report from Test no.	Locality	Emergence from seed treated with Fermate at rate of .335%	.168%	.085%	Untreated check	Diff. req. sign.	Calc. F value
		%	%	%	%	%	
01	Calif.	83.6	83.6	82.8	76.2	6.4	2.12
02	Conn.	53.6	51.8	36.2	8.0	9.9	34.20
06	Fla.	81.2	81.4	66.0	60.8	12.0	6.02
10	Ga.	72.0	71.4	75.2	67.4	5.2	2.81
13	Ill.	90.8	88.6	86.4	83.6	4.1	7.94
17a	Iowa	91.4	89.8	87.4	71.4	9.6	3.58
17b	Iowa	86.8	79.5	78.2	49.8	10.9	8.7
22	Mass.	88.0	87.8	82.6	69.6	6.5	10.22
24	Mich.	72.0	74.0	70.2	49.4	12.8	5.56
26	Minn.	93.4	90.4	93.2	90.6	3.1	3.33
31	N.J.	76.4	79.0	62.0	62.2	13.2	2.98
33	N.Y.	81.0	75.0	75.0	64.4	5.4	10.42
34	N.Y.	73.2	73.6	70.6	61.6	7.9	7.52
36b	N.Y.	90.4	87.6	89.8	78.6	3.0	5.61
40a	Ohio	71.6	74.6	70.4	66.4	6.5	9.77
40b	Ohio	88.8	83.8	82.8	73.0	5.8	7.46
40.1	Oreg.	81.8	81.8	81.8	75.0	8.6	2.15
44	Pa.	88.2	86.0	87.6	82.0	4.0	5.50
51	Va.	36.8	36.4	39.8	25.6	8.6	26.20
52	Wash.	72.4	77.2	75.0	73.2	7.3	2.51
54	Wash.	88.2	90.0	86.0	82.6	4.6	2.33
57	Wis.	82.4	84.2	76.2	72.0	6.6	4.35
Av. (Sign.)		79.3	78.5	75.2	65.6	---	---
12	Idaho	87.6	88.0	83.0	81.4	N.S.	0.06
28a	Miss.	80.0	62.2	63.4	59.0	N.S.	1.58
28b	Miss.	90.0	91.2	87.2	85.0	N.S.	1.64
30	Nebr.	86.4	87.2	88.4	82.0	N.S.	1.07
36a	N.Y.	97.6	96.8	97.2	96.4	N.S.	0.56
46	S.C.	83.0	78.2	82.6	83.4	N.S.	1.59
47	S.C.	94.6	94.4	93.8	90.4	N.S.	1.80
48	S.D.	84.8	80.2	75.4	77.8	N.S.	1.73
58	Wyo.	90.4	91.4	88.4	87.2	N.S.	1.99
60	Canada	93.0	94.0	91.0	90.5	N.S.	1.37
Av. (Not sign.)		88.7	86.4	85.0	83.3	---	---
GRAND AV.		82.2	81.0	78.3	71.1	---	---

Table 8. Relative scores for pea seed treatments based upon the number of tests in which they produced a significantly larger stand than any other treatment (Maximum score = 198).

Treatment tested	Number of tests treatment in Column 1 was superior to: Spergon at 0.35%	Spergon at 0.17%	Spergon at 0.08%	Arasan at 0.35%	Arasan at 0.17%	Arasan at 0.08%	Fermate at 0.35%	Fermate at 0.17%	Fermate at 0.08%	Untreated check	Score for treatment
Spergon .35%	--	1	3	3	6	6	7	7	16	20	69
Spergon .17%	1	--	1	3	6	6	8	10	15	18	68
Spergon .08%	0	0	--	3	3	4	3	7	11	19	50
Arasan .35%	1	1	3	--	6	6	5	10	12	19	63
Arasan .17%	0	0	0	1	--	1	1	6	9	17	35
Arasan .08%	1	0	0	1	3	--	1	2	8	18	34
Fermate .35%	0	0	1	1	2	3	--	1	6	17	31
Fermate .17%	0	0	0	0	1	1	0	--	4	19	25
Fermate .08%	0	0	0	0	1	1	0	0	--	13	15
None	0	0	0	0	0	0	0	0	0	--	0
Scores against treatment	3	2	8	12	28	28	25	43	81	160	

Table 9. Effect of seed treatment on yield of Thomas Laxton peas

Report from Test no.	Locality	Weight of vines and pods from 100 seed sown									Diff. req. sign.	Calc. "F" value
		Spergon at rate of			Arasan at rate of			Fermate at rate of			Untreated	
		.335%	.168%	.084%	.335%	.168%	.084%	.335%	.168%	.084%		
		gms.	gms.	gms.	gms.	gms.	gms.	gms.	gms.	gms.	gms.	
33	L.I.,N.Y.	62310	58561	61969	63502	61628	59356	61742	57027	63502	50325	6864	2.81
40	Ohio (pods)	692	662	618	700	591	509	602	549	585	498	61	10.79
51	Va.	4658	4452	3942	2986	2874	2442	2306	2158	2638	1694	839	11.83
47	S.C.	1447	1364	1414	1439	1567	1468	1502	1820	1463	1503	169	4.56
Average		17277	16260	16986	17157	16665	15944	16538	15388	17047	13505		
01	Calif.	2365	2352	2490	2690	2120	2388	2322	2395	2318	1930	N.S.	1.89
13	Ill.	1971	1982	2031	1947	2057	2059	1787	1868	1883	1974	N.S.	1.04
26	Minn.	3519	3317	3704	3679	3305	3608	3308	3363	3396	3587	N.S.	1.04
28b	Miss.	279	266	303	270	308	277	282	271	295	240	N.S.	0.94
30	Neb.	5206	5458	5410	5691	5051	5416	5138	5341	4946	5220	N.S.	0.52
48	S.D.	2592	2330	2336	2598	2602	2506	2474	2424	2440	2282	N.S.	1.00
52	Wash.	1728	1592	1544	1374	1515	1548	1744	1684	1461	1411	N.S.	0.55
58	Wyo.	3427	3622	3260	3440	3644	3483	3485	3238	3531	3311	N.S.	0.64
Average		2636	2621	2635	2711	2575	2661	2568	2573	2534	2494		

Several investigators took the time and effort to harvest the vines and weigh them, or to pick the pods and weigh them. The data are summarized in Table 9.

The various treatments increased the yields by 15 to 20% as an average of all tests. In the 4 tests where the differences were statistically significant the increase amounted to almost 30% for the better treatments. In one test (#51) the best treatment almost trebled the yield. Although there is no doubt that treatment was effective in increasing yields, no sound conclusion can be reached from the data on the relative value of the different treatments.

Summary. All 3 organic materials can be profitably used as pea seed treatments. Significant improvement in emergence was secured in 69% of the localities, and yields were increased by an average of 15 to 30%. Spergon was more consistently beneficial than the other 2 materials and gave practically as good results when used at 0.17% (1.5 oz./bu.) as at double this rate. The other 2 materials gave better results at 0.35% than at lower dosages. The value of Fermate as a pea seed protectant may be seriously questioned, but Arasan can be used at the heavier rate of application.

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IV. LIMA BEAN SEED TREATMENTS

J. C. Walker and W. W. Hare

The Henderson Bush variety of lima bean was used in these tests. The seed was furnished gratis by the Ferry-Morse Seed Company. The following treatments were made in a rotary seed treater: Spergon at 0.2% by weight (0.5 oz. per 15 lb. of seed), and 0.1%; and Fermate at 0.2% and 0.1% by weight. Five replications of 100 seeds each from these treated lots and from an untreated control were planted in randomized blocks by the cooperators under field conditions in all tests except 36b.

The locations, planting dates, soil type, reaction, and moisture at time of planting, precipitation, range of maximum and minimum air temperatures from planting to average date of emergence, and average number of days from planting to emergence are set forth in Table 10.

In Table 11 are given the data from the individual locations, showing the average number of seedlings for each treatment, calculated F value, and the minimum difference in the means required for significance. There were significant differences in 11 of the 26 tests. However, the treatments were significantly better than the check in only 9 tests, since the difference in tests 28b and 35 was between different treatment only.

The data from group analyses of combined tests (method of E. B. Roessler and L. D. Leach) are given in Table 12. When tests 10, 52, and 33 are omitted, the remaining 23 tests (group 2) form a homogeneous group. Tests 10, 52, and 33 (group 1) also form a homogeneous group. In group 1, Spergon at 0.2% and Fermate at 0.2% were significantly better than the check.

In group 2 all treatments are significantly better than the check and Spergon at 0.2%, Spergon at 0.1%, and Fermate at 0.2% are better than Fermate at 0.1%. Spergon at 0.2% and Spergon at 0.1% show no differences, but both are better than Fermate at 0.2%. For practical purposes this analysis indicates the use of Spergon at 0.1% by weight or Fermate at 0.2% by weight, the choice depending on cost and availability.

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Table 10. Location, time, and environmental conditions of lima bean seed treatment tests with the Henderson Bush variety -- 1943

Test no.	State	Planting date	Soil			Rainfall	Air temperature	Days to emerge
			Type	pH	Moisture			
						In.	°F	
10	Ga	3/29	---	5.0	Opt.	0.40	35-86	7
52	Wash.	5/27	Sandy loam	5.7	Opt.	1.05	38-79	--
33	N.Y.	5/28	Loam	5.1	Opt.	2.06	52-92	7
40	Ohio	6/8	Silt loam	6.7	Dry	0.24	52-90	6
34	N.Y.	6/4	Fine sandy loam	6.2	Opt.	1.32	55-92	13
17	Iowa	5/8	Clay loam	6.8-7.2	Opt.	--	--	--
13	Ill.	6/3	Clay loam	6.4	Wet	0.19	53-86	4
36b	N.Y.	5/15	Compost loam	6.99	Opt.	Watered	70-80	--
26	Minn.	5/3	Silt loam	5.7	Dry	2.34	30-87	--
57b	Wis.	5/20	Miami silt loam	6.2	Wet	0.43	46-80	8
8	Fla.	1/29	Fine sandy loam	6.5±	Opt.	0.28	35-83	11
46	S.C.	3/24	Sandy loam	5.5	Opt.	0.57	30-83	12
44	Pa.	6/12	Clay loam	6.8	Opt-dry	0.04	54-93	6
36a	N.Y.	6/11	Silt loam	7.55-7.6	Opt.	1.91	50-96	--
41	Okla.	6/6	Loam	Sl. acid	Opt.	0.32	65-91	5
55	W.Va.	5/18	Clay loam	7.4	Opt.	--	60-88	16
22	Mass.	5/24	Sandy loam	5.9-6.0	Opt.	0.30	43-93	9
28a	Miss.	4/21	Sandy loam	--	Opt.	0	39-92	6
58	Wyo.	5/25	Sandy loam	7.5	Opt.	0.08	31-80	11
1	Calif.	4/30	Fine sandy loam	7.2	Opt.	0	38-89	8
31	N.J.	7/17	Fine sandy loam	5.6	Opt.	0.39	60-92	6
28b	Miss.	4/1	Silt loam	5.4	Dry	0.06	48-88	10
47	S.C.	4/22	Sandy loam	5.8	Opt.	1.61	42-88	6
35	N.Y.	6/3	Sandy loam	5.63	Dr	1.65	55-92	8
51	Va.	5/5	Silt loam	5.9	Opt.	2.49	50-96	12
57a	Wis.	4/21	Miami silt loam	6.2	Wet	1.38	28-81	19

Table 11. Summary of individual tests with Henderson Bush lima beans, analyzed as randomized block tests

Test no.	State	Average number of seedlings: Spergon 0.2%	Spergon 0.1%	Fermate 0.2%	Fermate 0.1%	Check	F value	MSD
10	Ga.	75.6	55.8	72.6	73.4	74.2	1.5	NS
52	Wash.	71.6	68.0	60.8	52.6	40.4	9.94	13.4
33	N.Y.	77.6	76.0	74.4	68.2	72.4	1.05	NS
40	Ohio	72.6	68.6	68.2	68.2	65.6	0.49	NS
34	N.Y.	58.6	52.0	56.4	64.0	52.0	2.14	NS
17	Iowa	32.0	30.6	41.2	30.0	26.8	3.10	9.2
13	Ill.	75.2	73.2	70.8	64.6	64.4	2.65	NS
36b	N.Y.	47.0	31.0	18.8	15.0	9.4	24.91	9.0
26	Minn.	29.2	33.6	39.8	37.0	31.6	2.03	NS
57b	Wis.	41.2	38.8	47.8	44.2	34.6	3.18	8.5
8	Fla.	66.6	66.6	58.8	62.8	58.8	2.16	NS
46	S.C.	76.4	73.8	73.2	75.8	68.6	1.44	NS
44	Pa.	78.8	81.6	77.2	79.2	78.8	0.38	NS
36a	N.Y.	76.6	73.6	71.2	71.2	74.6	0.89	NS
41	Okla.	73.4	75.8	76.8	78.4	72.8	1.13	NS
55	W.Va	60.8	60.6	59.8	54.2	45.6	8.96	6.5
22	Mass.	80.0	77.8	74.8	73.2	70.4	3.11	6.4
28a	Miss.	67.6	62.2	61.6	61.4	48.0	11.73	6.3
58	Wyo.	41.6	40.0	42.0	44.0	29.8	6.95	6.4
1	Calif.	63.4	64.0	61.6	61.0	60.0	0.62	NS
31	N.J.	83.4	83.4	80.0	78.8	84.1	1.45	NS
28b	Miss.	77.0	76.4	76.4	68.2	73.8	3.24	6.1
47	S.C.	70.2	69.2	76.6	72.6	62.2	6.81	6.1
35	N.Y.	82.0	80.4	76.2	73.2	81.0	3.53	5.7
51	Va.	72.4	75.2	69.0	70.2	69.0	1.91	NS
57a	Wis.	5	3.2	4.2	6.8	2.4	1.06	NS

Table 12. Summary of group analyses of tests with Henderson Bush lima beans -- 1943

Group	No. of locations	Average number of seedlings: Spergon 0.2%	Spergon 0.1%	Fermate 0.2%	Fermate 0.1%	Check	Average error var.	F value	MSD
1	3[a]	74.9	66.6	69.3	64.7	62.3	91.33	3.85	7.0
2	23[b]	62.2	61.8	60.1	56.7	55.0	31.52	36.89	1.5

a -- Test nos. 10, 52, 33

b -- Test nos. 40, 34, 17, 13, 36b, 26, 57b, 8, 46, 44, 36a, 41, 55, 22, 28a, 58, 1, 31, 28b, 47, 35, 51, 57a

V. SOYBEAN SEED TREATMENTS

R. H. Porter

Cooperative tests of chemical protectants for soybeans were initiated during 1943. Seed of the field variety Mukden was treated and distributed to 15 cooperators in 13 States, while treated seed of the edible variety Kanro was tested by 4 cooperators. These cooperators planted 5 replications of 100 seeds each in 8 feet of row. Records on environmental conditions under which the tests were made are summarized in Table 13.

The protectants used were Spergon, 1 1/2 oz./bu. (.156 percent) and Arasan, Semesan Jr., and Fermate, each 1 oz./bu. (.104 percent). Data on emergence records of the various treated lots are summarized in Tables 14, 15, 16 and 17. Data from Georgia are omitted from these summaries because the soil was very dry at planting time, emergence was extremely variable, and the error for treatments was exceptionally high (423.34).

It may be noted in Table 14 that there were only 3 tests of the variety Mukden in which the differences between treatments are significant. Treatments gave a significant increase in germination in 2 cases at Minnesota and 3 at Virginia, while at Iowa 1 treatment gave a significant decrease in germination. In 3 other plots the differences between treated and untreated as a whole are significant but not between treatments. In the remaining 7 tests the differences between treated and untreated seed and between treatments were not significant.

A regrouping of the data by plots is shown in Tables 15 and 16 on the basis of small and intermediate errors. The data for Tennessee and Oklahoma showed rather large errors and are omitted.

The "F". value for the data in Table 15 is 7.9 and since the value for significance at the 5% point is 2.46 the data indicate a significant difference between treatments. The value for least significant difference is 2.38 which means that the mean percentages of germination at these 6 stations for 3 treatments are significantly greater than the untreated.

Analysis of the data in Table 16 show no significant differences between the means of treatments at the 5 locations.

The data for the variety Kanro are given in Table 17.

Table 13. Air temperature, soil reaction, and rainfall data from soybean seed treatment plots 1943.

Cooperating Station	Date range	Average air temperature Max.	Average air temperature Min.	Soil moisture at planting time	Soil pH	Total Rainfall (inches)	Days for Seedlings to emerge
Michigan	6/19			Optimum	6.8-7.2		3
Minn.[c]	5/15 6/13	69.1	51.8	Wet		9.57	
N.Y.(Cornell)	7/17 to 7/30	85.4	69.7	Wet	6.2	1.23+	4
N.Y.(Geneva)	6/16 to 6/29	89.8	64.6	Dry	7.6-7.8	1.74+	6-8
Okla.	4/22 to 5/10	81.3	58.0	Dry	Neutral to basic	5.21[a]	6
Penn.	7/31 to 8/20			Dry	6.9	2.01+	8
R. I.	5/14 to 6/10	65.8	46.6	Wet	6.2	1.33	11
S. Car. (Charleston)	4/13 to 4/23	71.0	46.5	Optimum	5.5	1.64	10
Tenn.	5/3 to 5/11	82.5	59.5	Optimum	5.6	.96	8
Virginia	5/26 to 6/ 2	78.3	52.9	Optimum	5.21	3.75[b]	--
West Va.	5/29 to 6/ 7	75.8	68.8	Optimum	7.4		10
Ga.	5/8 to 6/ 2	87.0	60.4	Dry	5.6	2.08	12
Wis.	5/27 to 6/10	73.6	58.6	Optimum	---	1.74	12
Iowa	5/20 to 6/3	76.5	55.0	Optimum	6.4-6.8	1.78	8
S. Car. (Edisto)	5/14 to 5/19	85.7	65.5	Dry	5.7	0.50	5

[a] All came 5/7 to 5/10 [b] Heavy rains May 30 and 31
[c] Average maximum soil temperature 67.7°F. and minimum 55.3°F.

Table 14. Percentage emergence of Mukden soybeans from treated and untreated seed. 1943.

Report from Coop. Station	Error	Average percentage field germination: Check	Arasan	Spergon	Sem.Jr.	Fermate	Least Dif. for sig.
Mich.	42.29	72.0	71.2	72.4	70.0	74.6	
Minn.	26.67	60.4	70.8	69.8	66.4	66.4[a]	6.91
N.Y.(Cornell)	47.4	74.2	68.8	73.8	73.6	70.6	
N.Y.(Geneva)	38.21	76.8	81.8	75.4	78.4	78.8	
Okla.	76.5	70.2	66.6	76.6	67.2	68.6	
Pa.	19.37	78.6	79.4	81.8	78.4	75.2	
R. I.	13.1	74.6	77.4	81.2	78.8	75.0[b]	
S. Car.	12.26	82.6	87.0	86.4	88.2	82.6[b]	
Tenn.	89.78	46.4	59.4	61.6	53.4	52.2[b]	
Va.	26.23	48.8	53.4	58.6	47.0	55.6[a]	2.8
W. Va.	41.13	76.2	76.4	80.0	78.6	80.4	
Wis.	30.64	81.6	81.4	78.2	78.2	81.8	
Iowa	14.29	80.2	80.2	80.2	83.6	75.4[a]	3.68

[a] Differences between treatments significant and also between check and some of the treatments.
[b] Differences between check and treatment or treatments significant.

Table 15. Summary of field germination data from 6 plots planted with treated and untreated Mukden soybean seed 1943.

(Small error)

Report from	Error	Percentage of emergence				
		Check	Arasan	Spergon	Semesan Jr.	Fermate
Minn.	26.67	60.4	70.8	69.8	66.4	66.4
Penn.	19.37	78.6	79.4	81.8	78.4	75.2
R. I.	13.1	74.6	77.4	81.2	78.8	75.0
So.Car.	12.26	82.6	87.0	86.4	88.2	82.6
Va.	26.23	48.8	53.4	58.6	47.0	55.6
Iowa	14.29	80.2	80.2	80.2	83.6	75.4
Mean		70.9	74.7	76.3	73.7	71.7

Table 16. Summary of field germination data from 6 plots planted with treated and untreated Mukden soybean seed. 1943

(Intermediate Error)

Report from	Error	Percentage of Emergence				
		Check	Arasan	Spergon	Semesan Jr.	Fermate
Mich.	42.29	72.0	71.2	72.4	70.0	74.6
N.Y. (Cornell)	47.4	74.2	68.8	73.8	73.6	70.6
N. Y. (Geneva)	38.21	76.8	81.8	75.4	78.4	78.8
W. Va.	41.13	76.2	76.4	80.0	78.6	80.4
Wis.	30.64	81.6	81.4	78.2	78.2	81.8
Mean		76.2	75.9	76.0	75.8	77.2

Table 17. Summary of field germination data from 4 plots planted with treated and untreated Kanro soybean seed 1943.

Report from	Error	Percentage of emergence				
		Check	Arasan	Spergon	Semesan Jr.	Fermate
Iowa	12.41	80.4	89.0	85.2	85.4	88.6
N.Y. (Geneva)	17.88	83.4	87.8	89.2	83.4	86.8
Okla.	27.08	76.8	89.0	85.8	77.2	84.6
S. Car.	8.36	89.2	93.8	91.8	93.4	94.2
Mean		82.4	89.9	88.0	84.8	88.6

Table 18. Yield of soybeans from plots planted with treated and untreated seed. Ames, Iowa, 1943.

Variety	Mean number grams per 8 foot row				
	Check	Arasan	Spergon	Semesan Jr.	Fermate
Mukden	475.3	490.3	477.9	483.6	484.2
Kanro	356.5	399.9	364.7	361.4	368.8

Analysis of variance of the data from each station in Table 17 as well as from the stations as a whole gives the following results:

1. Differences between treatments are significant at Iowa and Oklahoma with the least difference for significance being 4.72 for the former and 7.01 for the latter.
2. The difference between untreated and treated is significant at South Carolina but not at New York.
3. Analyzing the data as a whole the "F" value is 11.2 with an "F" value of 2.51 required for significant difference at the 5% point between treatments. The figure for least significant difference between the means of the counts at the 4 stations is 2.28 which indicates that for the results as a whole each treatment increased the germination significantly above the untreated. Three treatments were about equal and one was less effective than the others.

One other test was made at Edisto, South Carolina with the variety Volstate. The percentages of germination were Check 14.6, Arasan 34.0, Spergon 64.4, Semesan Jr. 47.0, and Fermate 57.8. The benefit from treatment was very pronounced.

Yield data from the 2 varieties Mukden and Kanro were obtained at the Iowa station. The results are given in Table 18. Analysis of the data showed no significant differences in the yields from rows planted with treated and untreated seed.

It is believed that the data from these several tests made in 1943 indicate that further studies are necessary. The tests in 1944 will be made only with a vegetable variety and different dosages will be used.

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VI. SPINACH SEED TREATMENTS

Richard P. Porter

During the 1943 growing season, the following chemical seed treatments were tested on spinach: Arasan at dosages of 0.25, 0.50, 0.75, and 1.00%; Fermate at 0.25, 0.50, 0.75, and 1.00%; and zinc oxide at 2.00%. Forty-seven sets of data from 39 cooperators located in 30 States of the United States and 2 Provinces of Canada were submitted for summation and final analysis.

The data in Table 19 show the geographical location, the cooperator, and the environmental conditions under which each test was conducted.

Table 20 is a summary of all the spinach tests conducted in 1943, ranked according to the magnitude of their error variances. This grouping of tests facilitates the application of the Chi-square test of the homogeneity of the data from the different locations. Twenty-four tests with low error variances are given together in one homogeneous group (Group I), and 20 tests with higher error variances form Group II. Although 2 of the 3 remaining tests form a third homogeneous group (Group III), representative of the performance of the treatments in a limited area, they probably should not be considered as typical.

Emergence. The least difference required for significance between the means of Group I is 1.5 seedlings (Table 21). All treatments significantly increased emergence, Arasan at 1.00% being the best treatment with a mean germination of 69.9 seedlings. The only treatments significantly lower in germination than Arasan 1.00%, are Arasan 0.25% and Fermate 0.25%, 0.50%, and 0.75%. Fermate 0.25% is the only treatment significantly less than zinc oxide 2.00%.

The least difference required for significance between means of Group II is 2.6 seedlings (Table 21). All treatments significantly increased emergence, and Arasan at 1.00% is again the best. Arasan at 0.25% and Fermate at 0.25% and 0.50% are the least favorable of the treatments and show a mean germination significantly less than the best treatment, and are significantly less than zinc oxide 2.00%.

Group III, made up of only 2 tests, is homogeneous, but too few tests are included to make valid estimates of the value of the different treatments.

Damping-off. In 10 of the 47 tests conducted this year enough post-emergence damping-off occurred for the cooperators to make counts. Table 22 shows the total number of seedlings emerged, the total number damped-off, and the percentage of post-emergence damping-off for each treatment. The results for these 10 tests indicate that seed treatment tends to reduce post-emergence damping-off. Arasan is evidently the most effective fungicide in this respect, since seed treated with 1.00% showed an average of 7.2% post-emergence damping-off while the untreated seed showed 17.2%. The zinc oxide 2.00% treatment was approximately as affective as

Table 19. Location, time, and environmental conditions of spinach seed treatment tests -- 1943

Report from: Test no.	Locality	Planting date	Planted in[a]	Soil condition: pH	Soil condition: Moisture	Rainfall In.	Av. temperature Min.-Max. °F.	Days to emerge	Soil type
1	Calif.	2/17	--	7.1	---	1.51	42.8-64.0	18	Fine sandy loam
2	Conn.	2/25	GB[a]	5.25	Wet	--	59.3-84.5	15	Fine sandy loam
3	Conn.	5/17	Field	6.2	Opt.	3.90	48.3-70.6	18	Sandy loam
5	Del.	4/24	Field	--	Opt.	.01	42.7-70.0	11	Sandy loam
6	Fla.	2/20	Field	6.5	Opt.	0.89	48.3-69.9	8	Loamy fine sand
7	Fla.	3/2	Field	5.8	Opt.	3.77	46.6-68.1	6	Loamy sand
9	Fla.	3/10	Field	7.2	Dry	0.61	57.6-79.1	5	Sandy loam
10	Ga.	2/13	Field	5.4	Opt.	0.50	31.4-61.1	10	Tifton series
12	Idaho	5/25	Field	--	Opt.	0.35	42.8-61.7	12	Silt loam
11	Ga.	4/15	GF[a]	5.5	Opt.	3.26	43.9-69.3	12	Sandy loam
13	Ill.	5/18	GF	7.5	Opt.	--	-- --	5	Sandy loam
17	Iowa	4/8	--	6.8	Opt.	--	-- --	--	Clay loam
20	Md.	4/8	Field	5.6	Dry	2.92	35.4-61.3	19	Sandy loam
22	Mass.	4/29	Field	5.9	Opt.	1.88	39.0-65.7	12	Gr. sandy loam
24	Mich.	5/4	Field	6.8-7.2	V.wet	--	-- --	23	Sandy loam
26	Minn.	4/23	Field	5.7	Opt.	0.59	38.4-60.5	21	Silt loam
28a	Miss.	2/26	Field	5.4	Opt.	3.82	37.5-57.5	17	Silt loam
28b	Miss.	2/25	Field	4.5	Opt.	3.11	37.2-57.1	10	Sandy loam
28c	Miss.	2/25	Field	6.7	Opt.	3.99	32.8-55.9	19	Fine sandy loam
28d	Miss.	2/24	Field	5.7	Opt.	1.54	31.2-53.7	14	Ochlochnee loam
31	N.J.	9/25	Field	5.8	Dry	0.21	48.9-73.0	8	Sassafras loam
33	N.Y.	3/27	Field	5.1	Opt.	1.65	32.4-48.9	23	Sassafras loam
34	N.Y.	7/2	Field	6.2	Opt.	2.64	64.1-78.0	7	Fine sandy loam
35	N.Y.	6/26	GB	6.6	Opt.	2.16	65.4-80.7	12	Sandy loam
36a	N.Y.	5/14	GF	6.99	Opt.	--	-- --	10	Silt loam compost
36b	N.Y.	5/18	Field	7.77	Wet	4.70	54.3-75.3	23	Silt loam
39	N.D.	4/15	Field	7.00	Opt.	0.73	33.3-60.2	12	Fargo clay
40a	Ohio	4/29	Field	5.5	Opt.	1.42	45.7-68.1	17	Muck
40b	Ohio	5/4	Field	6.5	Opt.	2.67	48.0-67.0	15	Silt loam
41	Okla.	4/8	Field	6.8	Opt.	1.08	50.6-75.4	8	Loam
43.1	Oreg.[b]	5/8	Field	5.9-6.1	Opt.	0.20	43.3-68.0	18	Clay loam
44	Pa.	4/28	Field	6.8	Opt.	0.34	44.0-66.6	9	Clay loam
45	R.I.	5/7	Field	6.2	Wet	2.82	46.7-65.5	12	V.f.sandy loam
46	S.C.	3/19	Field	6.1	Opt.	2.57	42.9-69.2	8	Sandy loam
47	S.C.	3/11	Field	5.8	Opt.	0.63	53.7-74.1	7	Sandy loam
48	S.D.	4/24	Field	6.5	Dry	0.94	37.1-64.1	28	Sandy loam
49	Tenn.	3/10	Field	7.0	Opt.	2.88	44.2-67.1	10	Sandy loam
50	Texas	3/1	Field	7.0	Opt.	0.00	50.4-75.8	10	Fine sandy loam
51a	Va.	2/3	GB	5.75	Opt.	--	67.5-82.8	6	Silt loam
51b	Va.	9/15	Field	6.05	Wet	1.22	81.0-88.1	9	Silt loam
51c	Va.	3/12	Field	6.2	Opt.	0.96	46.4-70.1	9	Silt loam
52	Wash.	5/19	Field	5.7	Dry	0.83	43.5-68.0	18	Sandy loam
55	W.Va.	5/20	GF	5.4	V.wet	--	-- --	12	Loam
57	Wis.	4/21	Field	6.5	Opt.	1.01	45.1-65.9	15	Miami silt loam
58	Wyo.	4/29	Field	7.5	Opt.	0.45	37.1-52.1	21	Sandy loam
59	Canada	6/3	GF	--	Opt.	--	54.0-91.3	6	Greenhouse comp.
60	Canada	6/1	GB	7.5	Opt.	--	52.1-80.4	9	Sandy loam

a -- GB = greenhouse bench; GF = greenhouse flats

b -- Oregon, test made by P. W. Miller and F. P. McWhorter

Table 20. Summary of spinach seed treatment tests analyzed separately as randomized block experiments.

Report from: Test no.	Locality	Average number of seedlings emerged: Arasan 0.25 %	Arasan 0.50 %	Arasan 0.75 %	Arasan 1.00 %	Fermate 0.25 %	Fermate 0.50 %	Fermate 0.75 %	Fermate 1.00 %	Zinc oxide 2.00 %	Untreated	Error: variance (V_i)	Log V_i
49	Tenn.*	79.8	78.6	76.6	79.6	78.4	85.4	75.0	75.6	80.2	63.6	3.0	0.4771
51c	Va.	84.2	81.4	81.0	86.2	79.8	82.2	81.8	81.2	82.8	80.2	12.0	1.0792
59	Canada*	82.2	83.2	82.2	83.4	85.0	84.4	85.0	85.6	81.2	72.2	15.5	1.1903
33	N.Y.*	81.2	78.6	76.0	83.8	78.0	81.0	80.6	81.4	80.8	57.8	20.4	1.3096
51a	Va.	53.8	57.4	56.0	58.6	59.2	53.4	58.2	56.4	57.2	49.0	22.4	1.3502
60	Canada*	88.2	87.8	87.0	91.0	90.6	87.2	86.4	86.0	88.4	72.4	22.7	1.3560
51b	Va.	69.6	69.2	71.8	74.8	56.6	67.2	67.0	72.8	69.8	41.0	24.2	1.3838
47	S.C.*	74.8	78.6	81.0	67.8	72.4	69.2	78.0	79.6	72.2	64.4	25.6	1.4082
40b	Ohio*	63.4	63.4	63.2	68.6	49.0	63.2	59.4	60.2	61.8	27.2	27.6	1.4409
39	N.D.	75.4	75.6	68.8	72.0	74.4	72.0	78.2	72.4	73.8	72.0	28.9	1.4609
11	Ga.*	63.4	64.0	69.0	67.0	62.4	72.8	63.2	70.4	53.8	67.2	33.2	1.5211
58	Wyo.*	69.6	60.4	57.8	60.2	61.4	66.6	66.0	58.4	61.6	66.4	33.9	1.5302
22	Mass.*	80.4	76.2	81.6	80.2	83.4	75.8	81.6	81.4	81.2	62.6	34.4	1.5366
28a	Miss.*	64.8	64.4	67.8	73.4	67.0	61.6	66.8	67.2	67.0	41.4	35.8	1.5539
57	Wis.*	76.0	71.6	74.6	66.8	75.2	71.8	73.2	72.2	74.0	54.4	41.0	1.6128
44	Pa.*	79.0	74.2	75.0	79.2	66.6	73.2	76.4	80.8	78.0	48.6	42.5	1.6284
3	Conn.*	53.4	63.0	54.4	65.8	54.6	55.6	57.2	57.4	58.8	44.2	43.3	1.6365
10	Ga.*	45.8	47.0	45.4	43.6	47.4	51.6	55.0	54.0	57.4	43.8	44.6	1.6493
36b	N.Y.	13.0	18.8	18.6	13.8	16.2	12.2	17.2	17.0	21.8	13.2	45.3	1.6561
36a	N.Y.*	74.6	78.8	79.6	76.8	55.6	72.4	71.4	72.6	63.6	41.6	45.8	1.6609
21	Calif.*	64.4	70.6	75.6	73.8	67.8	65.0	70.4	67.0	72.4	60.2	49.0	1.6902
40a	Ohio*	61.0	72.0	69.8	67.2	68.2	66.0	60.4	72.8	75.8	53.2	52.2	1.7177
17	Iowa*	56.8	64.4	68.0	63.2	68.2	68.0	64.6	56.2	56.6	54.8	55.5	1.7443
31	N.J.*	69.6	73.8	68.0	80.0	50.8	67.6	67.8	73.4	77.8	65.6	59.3	1.7730
Average		67.7	68.9	68.7	69.9	65.4	67.3	68.4	68.8	68.7	54.9		
9	Fla.*	68.6	70.0	70.6	69.4	63.2	72.8	67.6	69.6	71.8	39.8	63.5	1.8028
41	Okla.*	45.0	50.2	50.2	48.8	47.8	49.8	49.0	56.4	56.8	14.8	63.5	1.8028
5	Del.*	55.0	59.6	56.4	64.4	52.4	56.2	65.2	52.0	58.8	38.8	66.4	1.8222
46	S.C.*	67.8	69.6	63.0	70.4	62.4	63.8	67.6	68.8	60.2	30.4	66.6	1.8235
24	Mich.*	52.2	50.2	51.8	51.8	46.8	45.2	50.8	55.2	51.4	16.0	68.0	1.8325
28b	Miss.*	50.0	65.8	59.0	64.2	53.4	53.8	61.8	63.0	59.4	42.0	69.6	1.8426
28d	Miss.	65.6	62.0	66.0	65.2	65.6	65.0	69.8	67.0	70.4	60.2	72.8	1.8621
26	Minn.	53.8	52.0	60.8	59.6	53.0	55.6	58.6	52.2	52.8	46.4	73.3	1.8651
55	W.Va.*	61.8	68.6	65.8	74.2	62.4	76.2	70.6	75.0	65.4	44.8	77.7	1.8904
34	N.Y.*	39.6	40.4	43.4	51.8	40.0	29.2	45.2	46.6	41.4	26.8	79.2	1.8987
45	R.I.*	44.4	47.6	54.2	47.6	33.2	54.0	52.0	43.6	57.4	21.8	86.3	1.9360
7	Fla.*	65.4	62.0	58.4	61.4	58.2	60.0	69.2	67.6	60.6	45.4	86.7	1.9380
35	N.Y.	62.2	58.8	64.6	62.0	60.8	60.8	75.4	65.0	74.6	60.6	88.0	1.9445
6	Fla.	71.8	66.4	73.2	79.8	70.8	70.2	77.0	72.6	75.8	68.2	89.6	1.9523
50	Texas*	66.0	75.6	74.0	73.6	60.0	68.0	72.2	78.4	69.2	35.2	92.3	1.9652
43.1	Oreg.	32.6	34.3	38.6	36.4	37.6	45.8	33.0	40.6	48.0	36.6	93.2	1.9694
48	S.D.	50.0	61.4	57.4	60.0	46.2	52.2	55.6	55.4	53.0	55.4	94.4	1.9750
20	Md.	27.6	19.0	13.4	16.6	21.4	20.4	20.6	13.2	13.8	13.6	110.2	2.0422
13	Ill.*	47.4	66.0	53.8	65.2	39.2	45.4	51.4	51.4	50.0	22.4	163.4	2.2132
2	Conn.*	53.4	59.8	57.2	51.2	21.2	50.4	58.6	56.0	55.2	21.8	169.1	2.2281
Average		53.9	57.0	56.6	58.7	49.8	54.7	58.6	57.5	57.3	37.0		
12	Idaho*	45.0	44.4	45.0	48.8	40.8	41.6	47.2	41.6	65.6	26.0	180.5	2.2565
52	Wash.	68.4	69.6	64.0	68.8	64.8	65.6	69.6	70.0	68.0	41.4	185.5	2.2683
Average		56.7	57.0	54.5	58.8	52.8	53.6	55.4	55.8	66.8	33.7		
28c	Miss.	22.4	36.4	32.0	20.2	18.8	29.6	43.2	19.4	37.8	23.0	399.9	2.6019

*Significant differences between treatments were indicated by the analyses at these locations *

Table 21. Effect of chemical seed treatments on emergence of spinach seedlings

Reports on Group	No. locations	Average number of seedlings: Arasan 0.25%	Arasan 0.50%	Arasan 0.75%	Arasan 1.00%	Fermate 0.25%	Fermate 0.50%	Fermate 0.75%	Fermate 1.00%	Zinc oxide 2.00%	Untreated	Av. error variance	Least diff. req. sign.
1	24	67.7	68.9	68.7	69.9	65.4	67.3	68.4	68.8	68.7	54.9	34.09	1.5
2	20	53.9	57.0	56.6	58.7	49.8	54.7	58.6	57.5	57.3	37.0	88.69	2.6
3	2	56.7	57.0	54.5	58.8	52.8	53.6	55.4	55.8	66.8	33.7	183.00	12.1

Table 22. Effect of chemical seed treatments on post-emergence damping-off of spinach seedlings.

Records on	Arasan 0.25%	Arasan 0.50%	Arasan 0.75%	Arasan 1.00%	Fermate 0.25%	Fermate 0.50%	Fermate 0.75%	Fermate 1.00%	Zinc oxide 2.00%	Untreated
Emergence	3208	3493	3376	3493	2860	3326	3327	3454	3350	2032
Damped off	370	345	259	252	450	382	321	295	366	349
Percent damped off	11.5	9.9	7.7	7.2	15.7	11.5	9.6	8.5	10.9	17.2

Table 23. Cost of treating 100 pounds of spinach seed with Arasan, Fermate, or Zinc Oxide at different dosages.

Treatment	Cost for treatment at dosage: 0.25%	0.50%	0.75%	1.00%	2.00%
	$	$	$	$	$
Arasan[a]	0.29-0.40	0.57-0.80	0.86-1.20	1.15-1.60	
Fermate[b]	0.15	0.30	0.45	0.60	
Zinc oxide[c]					0.45-0.60

[a] Quoted July 19, 1943, sold in 8 oz. to 100 lb. containers.
[b] Quoted September 25, 1943, sold in 25 lb. fiber drums.
[c] Quoted July 1943, cost includes price of graphite.

Arasan at 0.25% and Fermate at 0.50% (Table 22).

Cost of Treatment. The cost of treating 100 pounds of spinach seed with Arasan, Fermate, or zinc oxide at different dosages is given in Table 23. Although Arasan is the most expensive fungicide, and Fermate is more costly than zinc oxide, the cost of treatment at minimum effective dosages is approximately the same for all 3 materials. It should be pointed out, however, that graphite, a disagreeable material to handle, probably should be added to Fermate at all dosages tested, and to Arasan at the higher dosages when seed is to be drilled. This will increase the cost of treatment slightly.

Summary and Conclusions.

1. Results from 47 tests conducted during 1943 at various locations in the United States and Canada indicated that chemical treatments of spinach seed with Arasan and Fermate at dosages 0.25, 0.50, 0.75, and 1.00%, and zinc oxide at a dosage of 2.00% significantly increased emergence.

2. Arasan (0.50, 0.75, and 1.00%) and Fermate (0.75 and 1.00%) treatments proved to be equal or superior to the standard zinc oxide (2.00%).

3. Data from 10 tests showed that chemical treatment of spinach seed apparently had some effect in reducing post-emergence damping-off. The most effective treatment (Arasan at 1.00%) reduced it by 10%.

4. The cost of treatment with the various materials at minimum effective dosages is approximately equal.

5. Chemical dust seed treatments recommended to control seed decay and reduce damping-off of spinach are Arasan 0.50%, or Fermate 0.75%, or zinc oxide 2.00%. Graphite probably should be added to the Fermate or zinc oxide-treated seed if it is to be sown by planter.

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VII. BEET SEED TREATMENTS

L. D. Leach

Garden beet seed of the variety Detroit Dark Red was treated with 3 fungicides, Yellow Cuprocide, Arasan, and Ceresan, at 3 different dosages and planted along with non-treated seed in randomized plots consisting of 5 replications. Yellow Cuprocide was used at 1.0, 2.0 and 3.0% of the seed weight; Arasan at 0.25, 0.5 and 1.0%; and Ceresan at 0.5, 1.0 and 1.5%.

Nineteen complete tests were conducted by cooperators at 16 experiment stations and the results are presented in Tables 24 and 25. Only 3 of the 19 tests showed significant differences. Two tests (No. 13 and 40b) indicated that the intermediate or higher dosages of each material significantly increased the stand as compared to the non-treated while the third test (No. 22) showed only indications of stand reduction from certain treatments. Considered individually these tests yield little information on the relative efficacy of different dosages of the 3 fungicides.

An analysis of the combined results of the 19 tests show that their variances do not represent a homogeneous group[1]. To produce a homogeneous group it is necessary to eliminate 9 of the tests, 4 with high and 5 with low variances. The averages for the remaining 10 tests are as follows:

Emergence from seed treated with									
Yellow Cuprocide			Arasan			Ceresan			Non-
1.0%	2.0%	3.0%	0.25%	0.50%	1.0%	0.5%	1.0%	1.5%	treated
98.7	95.8	96.9	98.9	101.3	103.9	99.2	100.2	101.4	90.0

An analysis of the variance ratio leads to a significant F value and the significant difference between the means of treatments at the 5% points is found to be 5.8 seedlings. It therefore appears that all treatments significantly improved the emergence as compared with the non-treated. Arasan at 1% dosage is significantly better than Yellow Cuprocide at 2.0 or 3.0% but there are no other significant differences between treatments.

With the elimination of only 2 tests it is possible to divide the remaining 17 into 2 homogeneous groups with 9 and 8 tests respectively. The averages for these 2 groups are as follows (page 32, bottom):

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[1] Roessler, E. B. and L. D. Leach
Analysis of combined seed treatment tests. (Mimeographed)

Table 24. Location, time, and environmental conditions under which tests were conducted.

Report from Test No.	Locality	Planting date	Soil conditions: Soil type	Soil conditions: Reaction	Soil conditions: Moisture	Precipitation	Temperature of air: Max.	Temperature of air: Min.	Days to emerge
				pH		in.	°F.	°F.	
01	Calif.	2/18	Sandy loam	7.2	Opt.	.86	64	42	11
02	Conn.	2/10	F.Sandy loam	5.2	Wet	W	91	56	4-6
10	Ga.	3/15	---	5.4	Opt.	1.13	74	47	10
13	Ill.	5/18	Sandy loam	6.9	Opt.	---	--	--	5
17	Iowa	4/8	Clay loam	7.0	Opt.	---	--	--	--
22	Mass.	4/30	Sandy loam	6.0	Opt.	2.39	65	41	10
24	Mich.	5/4	Sandy loam	7.0	Wet	---	--	--	--
28a	Miss.	2/25	F. Sandy loam	6.7	Opt.	3.28	60	37	18-27
28b	Miss.	3/18	---	6.6	Opt.	.20	66	40	9
28c	Miss.	2/26	Silt loam	5.4	Opt.	3.82	56	37	12
34	N. Y.	6/28	F. Sandy loam	6.5	V.dry	4.01	78	64	--
36	N. Y.	6/22	Silt loam	7.8	V.dry	1.93	85	61	--
40a	Ohio	4/26	Silt loam	6.5	Opt.	1.92	62	38	--
40b	Ohio	4/29	Muck	5.5	Opt.	1.42	70	46	--
43.1	Ore.[a]	3/10	Clay loam	6.0	Opt.	.51	56	37	18
44	Pa.	4/29	Clay loam	6.8	Opt.	2.00	68	47	--
48	S. D.	4/28	Sandy loam	---	Dry	1.59	66	39	--
52	Wash.	5/19	Sandy loam	5.7	Dry	.83	68	43	--
54	Wash.	5/7	Loam	7.2	Wet	.72	57	38	--

[a] Conducted by P. W. Miller and F. P. McWhorter

Group I: Emergence from seed treated with								
Yellow Cuprocide			Arasan			Ceresan			Non-treated
1.0%	2.0%	3.0%	0.25%	0.50%	1.0%	0.5%	1.0%	1.5%	
99.7	92.9	94.7	99.3	100.0	102.2	98.4	99.0	99.4	94.0

Group II: Emergence from seed treated with								
Yellow Cuprocide			Arasan			Ceresan			Non treated
1.0%	2.0%	3.0%	0.25%	0.50%	1.0%	0.5%	1.0%	1.5%	
98.8	107.2	104.2	104.9	109.6	107.8	105.6	110.0	111.4	97.7

Table 25. Effect of seed treatments on emergence of garden beets.

Report from Test no.	State	Emergence from seed treated with: Yellow Cuprocide 1.0%	Yellow Cuprocide 2.0%	Yellow Cuprocide 3.0%	Arasan 0.25%	Arasan 0.50%	Arasan 1.0%	Ceresan 0.5%	Ceresan 1.0%	Ceresan 1.5%	Non-treated	Sign. diff.[a]	Calc.-"F" value
13	Ill.	85.6	129.2	112.4	91.2	129.2	101.4	120.6	150.8	124.8	59.2	36.3	4.39
22	Mass.	133.0	171.8	143.4	146.2	154.0	137.4	162.6	157.0	157.8	157.4	11.4	8.65
40b	Ohio	107.4	137.0	139.6	123.6	133.7	136.2	106.8	131.8	147.0	103.2	15.88	4.76
Av.	(Sign.)	108.7	146.0	131.8	120.3	139.0	125.0	130.0	146.5	143.2	106.6	---	--
01	Calif.	128.9	116.6	109.4	120.8	122.2	123.4	117.2	112.2	121.2	102.8	NS	0.80
02	Conn.	83.8	80.6	86.4	89.4	92.8	90.6	82.8	92.4	90.4	81.2	NS	1.27
10	Ga.	61.8	78.6	70.8	69.4	77.8	79.2	68.4	60.2	66.0	64.4	NS	0.89
17	Iowa	89.6	73.0	84.0	85.0	79.4	79.6	81.8	84.8	86.0	75.8	NS	0.93
24	Mich.	75.8	79.6	84.2	85.6	93.2	89.0	84.8	88.0	89.0	66.0	NS	1.72
28a	Miss.	43.2	57.0	45.6	66.8	65.8	64.2	38.4	26.4	61.0	44.4	NS	0.90
28b	Miss.	79.6	64.2	64.4	69.2	69.4	67.6	66.4	64.8	75.8	66.8	NS	0.59
28c	Miss.	147.6	142.2	133.8	135.0	142.0	155.2	144.0	142.8	141.6	122.6	NS	1.30
34	N.Y.	88.2	80.4	81.4	91.4	92.8	95.0	87.4	112.4	92.0	100.2	NS	1.96
36	N.Y.	44.8	48.4	43.2	52.4	48.2	55.6	55.2	49.6	42.8	39.6	NS	1.27
40a	Ohio	109.6	125.6	115.0	115.0	122.2	123.4	121.0	125.8	123.8	108.4	NS	2.12
43.1	Oreg.	146.0	141.6	137.8	142.2	153.2	150.2	149.6	150.6	154.8	150.2	NS	1.32
44	Pa.	126.8	122.8	133.8	127.2	126.8	128.0	128.2	128.8	119.0	115.8	NS	0.53
48	S.D.	81.0	63.2	67.6	81.4	75.4	85.6	82.0	76.6	76.6	82.8	NS	1.08
52	Wash.	110.0	91.4	107.6	109.8	110.8	105.4	110.2	100.6	105.4	94.4	NS	0.69
54	Wash.	73.2	76.4	83.6	89.6	82.8	80.8	81.4	92.2	97.4	96.4	NS	0.78
Av.	(Non-sign.)	93.1	90.1	90.5	95.6	97.2	98.3	93.7	94.3	96.4	88.2	---	--
Grand average		95.6	98.9	97.0	99.5	103.8	102.5	99.4	102.5	103.8	91.1	---	--

[a] Differences required for significances between means -- Odds 19 : 1

An analysis of Group I leads to a non-significant F value and therefore no significant difference between the means are indicated. Group II, however shows a highly significant F value and the difference required for significance at the 5% point is found to be 4.6 seedlings. In this group, therefore, all treatments except Yellow Cuprocide at 1% significantly improved emergence.

In addition to the complete tests, 5 tests including only single dosages of each fungicide were conducted with the following results:

Report from		Emergence from seed treated with					
Test No.	Locality	Yellow Cuprocide 2.0%	Arasan 0.5%	Ceresan 1.0%	Non-treated	Sign. Diff.	Calc. "F"
01 b	Calif.	147	141	165	138	N.S.	2.68
01 c	Calif.	182	176	179	65	19.1	167.69
01 d	Calif	49	99	125	16	32.3	21.55
22 b	Mass.	170	171	176	166	N.S.	1.40
36 b	N. Y.	132	128	121	102	N.S.	0.70

Test 01 b, c, and d were conducted in greenhouse flats while 22 b and 36 b were planted in the field. The soil in test 01 b was lightly and in test 01 c moderately infested with Pythium ultimum, while the soil in test 01 d was heavily infested with Rhizoctonia solani. The results of tests 01 c and 01 d indicate that the 3 materials were about equally effective against Pythium but Cuprocide was less effective against Rhizoctonia than Arasan or Ceresan.

The chief causal organisms were reported from 3 of the complete tests. Test 13 (Ill.) was planted in soil artifically infested with Pythium ultimum and most of the seedlings were infected by this fungus although about 10% of the seedlings were infected by Rhizoctonia. In test 44 (Pa.) Pythium was most abundant but Rhizoctonia was also present while in test 48 (S.D.) Pythium debaryanum was reported as the causal organism.

Previous cooperative tests with garden beets in 1940 and 1941 showed significant benefits from seed treatment in about 60% of the tests. The low incidence of infection in 1943 may be due to environmental conditions or to chance alone but the writer has secured evidence that the strain of Detroit Dark Red used in these tests is less susceptible to Pythium damping-off than several other strains of garden beets and sugar beets. This difference may be due to inherited resistance or to differences in rates of emergence which seemed to be related to the severity of preemergence damping-off.

Conclusions. - Only 3 of the 19 complete tests and 2 of the 5 minimum tests produced significant results but the averages of combined tests indicated that all 3 materials, Yellow Cuprocide, Arasan and Ceresan, were beneficial. In some tests the higher dosages of Yellow Cuprocide appeared to reduce emergence as was reported from the 1941 tests for Red Cuprocide but the differences were in most cases non-significant. Arasan appeared to be a favorable seed treatment for garden beet seed and these results indicate a dosage of about 0.5% to be satisfactory. Ceresan was also effective but

this material would have certain limitations for use in home gardens or for pre-treatment of seeds.

Differences, in general, were too small to justify definite conclusions concerning either materials or dosages from these tests.

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VIII. TOMATO SEED TREATMENTS

S. P. Doolittle

The 1943 trials of seed protectants for tomato were designed to determine the actual value of certain treatments now in general use and to compare them with others of more recent introduction which appear to have definite value.

The seed was treated at one point and distributed to the cooperators, who planted 5 replications of 100 seeds each in randomized blocks. The data were taken on a basis of total emergence and analysed statistically by a standard method.

The tomato tests consisted of 15 trials in different localities in 10 States. Nine were planted in the greenhouse and 6 in the field. Six of the greenhouse trials were in soil that was known to be infested with Pythium spp. or was artifically infested before planting. Two of the field tests were lost because of unfavorable weather and insect injury.

The treatments used were as follows: Yellow Cuprocide (1.5% by weight of seed); Arasan (0.3%); Spergon (0.3%); seed soaked 5 minutes in a 1-1200 "dip" of New Improved Ceresan; and seed soaked 1 hour in a solution of 2 ounces of copper sulfate in 2 gallons of water.

Table 26 shows the locations of the trials, planting dates, soil types, environmental conditions, and average number of days required for emergence.

Table 26. Location, time of planting, and environmental conditions for 15 cooperative tomato seed treatment tests conducted in 1943

Report from: Test no.	State	Planting date	Soil conditions: pH	Soil conditions: Moisture	Soil conditions: Soil type	Rainfall	Air temperature: Max.-Min.	Days to emerge
						In.	°F.	
01	Calif.[a]	2/9	6.8	Opt.	Fine sandy loam	--	80-37	14
06	Fla.	2/27	7.0	Opt.	Fine sandy loam	4.50	83-32	10
11	Ga.	5/17	5.5	Opt.	Norfolk sandy loam	1.50	98-52	16
13	Ill.[a]	4/21	--	Wet	Sandy loam	--	---	7
20.1	Md.[a]	4/8	5.8	Opt.	Sandy loam	--	89-60	9
20.1a	Md.[a]	4/28	5.8	Opt.	Sandy loam	--	90-67	10
34	N.Y.	4/26	6.5	Opt.	Sandy loam	4.45	85-44	17
35	N.Y.[a]	4/14	6.0	Opt.	Loam	--	---	13
36	N.Y.[a]	3/3	7.0	Opt.	Silt loam	--	75-63	8
36a	N.Y.[a]	5/14	6.8	Opt.	Silt loam	--	75-67	7
44	Pa.[a]	4/16	6.8	Opt.	Clay loam, 1/4 sand	--	85-62	10
52	Wash.	5/25	6.0	Opt.	Sandy loam	1.23	79-38	--
54	Wash.[a]	4/24	6.0	Opt.	Palouse loam, 1/3 peat	--	---	7

[a] Seed planted in greenhouse

Table 27. Effect of seed treatment on emergence of tomato seedlings.

Report from: Test no.	State	Emergence from seed treated with: New Improved Ceresan	Yellow Cuprocide	$CuSO_4$	Arasan	Spergon	Untreated check	Least sign. diff.[a]	Calculated "F" value
		%	%	%	%	%	%	%	
A. Significant tests									
01	Calif.	26.6	40.8	35.8	40.0	35.6	30.6	4.44	13.22
06	Fla.	23.0	55.4	71.4	53.2	48.6	58.8	16.38	8.19
13	Ill.[b]	57.8	67.6	66.8	35.0	17.6	20.4	18.99	7.40
20.1	Md.[c]	66.0	69.2	79.2	78.2	70.4	55.6	17.66	7.70
35	N.Y.	41.6	39.0	38.2	42.4	35.8	31.4	5.42	4.7
36	N.Y.[b]	77.0	79.4	86.6	82.0	85.4	82.2	4.56	2.19
36a	N.Y.[b]	74.2	72.8	77.0	75.8	83.4	61.4	8.87	5.76
44	Pa.[b]	72.6	84.0	87.0	83.0	64.0	48.8	5.5	60.9
52	Wash.	74.0	66.2	74.8	73.6	54.6	34.0	15.54	8.99
54	Wash.	64.6	61.6	69.8	61.2	35.6	34.8	12.8	15.16
Average (sign. tests)		57.7	63.6	68.6	62.4	53.1	45.8	---	---
B. Non-significant tests									
11	Ga.	28.8	34.2	30.0	43.2	32.0	31.4	NS	1.94
20.1a	Md.[c]	66.2	77.8	81.0	79.6	76.6	74.8	NS	1.79
34	N.Y.	45.6	65.2	63.2	61.8	57.8	54.0	NS	2.25
Average (non-sign. tests)		46.8	59.0	58.0	61.5	55.4	53.4	--	---
Grand Average		55.2	62.5	66.2	62.2	53.6	47.5	--	---

[a] At 5% point.
[b] Soil known to be infested with Pythium spp.
[c] Soil artificially infested with Pythium spp.

Table 28. Relative value of different protectants in improving emergence from tomato seed

Treatment used	Number of times a given treatment (Column 1) was superior to: Yellow Cuprocide	$CuSO_4$	Arasan	Spergon	New Improved Ceresan	Untreated check	Total[a] score
Yellow Cuprocide	---	1	1	4	1	7	14
$CuSO_4$	1	---	2	5	4	8	20
Arasan	0	0	---	5	4	7	16
Spergon	1	0	0	---	3	5	9
New Improved Ceresan	0	0	1	5	---	7	13
None	0	0	0	0	2	---	2

[a] Maximum value 50

The data on seedling emergence and their statistical significance are given in Table 27. Table 28 shows the number of tests in which seedling emergence for any one treatment was significantly better than that for any one of the other treatments and indicates the relative values of the various treatments in this set of tests.

All treatments gave stands significantly better than the checks in 3 of 10 trials (in nos. 36a, 44, and 52). Four of the 5 treatments were effective in 3 other trials (nos. 01, 35, and 54). In only 4 trials (in 06, 11, 20.1a, and 34) was there no significant advantage from at least one treatment.

The copper sulfate soak, Yellow Cuprocide, and the Arasan dust seemed slightly superior to the other treatments, but New Improved Ceresan was also quite effective. Spergon seemed to be somewhat less valuable but was fairly effective in several trials.

The New Improved Ceresan dip showed some reduction in germination and in 2 trials fell below the checks. This seemed to be due to chemical injury to the seed rather than to lack of protection. There is always some retardation of emergence with this material but stands rarely are as seriously reduced as in the 2 instances mentioned. Both of these were on light, sandy soil. In the remaining trials the reduction in stands would not have been of economic importance.

It would seem that Yellow Cuprocide, copper sulfate, and Arasan may be especially valuable as protectants. New Improved Ceresan is so valuable as a combined protectant and disinfectant that it also ranks close to the other 3 in spite of its tendency to delay emergence. Where surface disinfection is not desired, it would be less desirable.

Preliminary Tests of Seed Disinfectants For Tomatoes

Preliminary trials were made with tomato seed known to be contaminated with the organism causing bacterial canker and with seed thought to carry a surface contamination of Alternaria solani. Both lots of seed were treated as follows: Hot water, 52°C. for 30 minutes; 50°C. for 30 minutes; and a 1-1200 New Improved Ceresan dip for 5 minutes. The seed carrying bacterial canker was tested in 4 localities in the greenhouse. A trace of infection occurred with the untreated seed in 2 trials. This infection was too slight to warrant conclusions as to the value of the treatments. In one trial the hot water treatments did not appreciably reduce emergence below the checks, but New Improved Ceresan caused a marked reduction. In another trial with this seed, the New Improved Ceresan treatment caused a slight reduction. A third trial with another lot of seed showed a reduced emergence for the hot water treatments as compared with the New Improved Ceresan or the check. This probably was due to the age of the seed.

In 4 trials with a single lot of seed thought to be infested with Alternaria solani, there was no evidence of leaf or stem infection in any plants. No marked difference in emergence occurred with any treatment in 3 of the 4 trials. In the fourth no data are available on stand. These trials were conducted in localities other than those in which seed protectant trials with New Improved Ceresan gave much reduced stands.

BUREAU OF PLANT INDUSTRY, SOILS, AND AGRICULTURAL ENGINEERING, AGRICULTURAL RESEARCH ADMINISTRATION, U. S. DEPARTMENT OF AGRICULTURE, BELTSVILLE, MD.

IX. ONION SEED TREATMENTS

A. G. Newhall

Seed treatments for onion have been developed primarily as substitutes for the formaldehyde soil treatment used against smut. They have also proved effective in preventing damping-off, so they may be used to advantage in many areas where smut is not a major problem. Since the very heavy dosages (75-100%) required for smut control are undoubtedly superfluous for damping-off, 2 different sets of treatments were prepared for the 1943 cooperative tests and distributed according to the disease problems prevalent in different areas.

A. Tests for Smut Control

The 4 seed treatments listed in Table 29 were compared to 3 soil treatments for Early Yellow Globe onions by 10 different cooperators. Arasan and Fermate were chosen as the dust treatments since salts of the carbamic acid and related compounds have proved more effective against onion smut than other materials. Thiosan was used interchangeably with Arasan in some tests since it contains the same active ingredients (50% tetramethyl-thiuram disulfide) and had not given significantly different results in preliminary tests.

Table 29. Treatments applied to Early Yellow Globe onion seed in smut control tests.

Material	Rate employed
1. Arasan	100% (by weight)
2. Arasan	75% " "
3. Fermate	100% " "
4. Fermate	75% " "
5. Liquid Formaldehyde	1% at 15 cc per foot of row
6. Liquid Catex	2% " " " " " " "
7. Liquid Catex	2.5%" " " " " " "
8. Check	

The dust treatments were applied before the seed was distributed. Since it is difficult to secure adherence of such heavy dosages of material, each pound of seed was first treated with 70 cc of rosin-potash sticker[1]. The seed were then shaken in a large flask with the required

[1] The sticker was prepared by dissolving 90 gms of Grade K gum rosin (Resinous Products Chemical Co., Washington Square, Philadelphia) in 700 cc of boiling potash solution containing 17 gms of KOH. An alternate sticker can be prepared with 1 part of potash to 6 parts of FF wood rosin (Crystal Soap & Chemical Co., Tacony, Pa.). Powdered resins with diluents are unsatisfactory.

amount of dust until all of them were thoroughly coated. After the seed had dried, enough of each treatment was distributed to each cooperator for 5 replications of 100 seeds each. Enough untreated seeds were included for the control and the 3 soil treatments: 1% formaldehyde, 2% catex (an alkaline distillate of southern pine stumps), and 2.5% catex. The solutions were dripped on the seed at the rate of 15 cc per foot of row by the cooperator before covering the seed.

Table 30. Cooperators and conditions in onion smut control tests.

Code no.	State	Cooperator	Location of test	Soil type	Notes
10.	Ill.	M. B. Linn	Field	Sandy loam	Too wet at sowing time
17.1	Mass.	T. Sproston Jr. & O. C. Boyd	Field	Heavy silt loam	Rained in 2 hrs. after sowing
19.1	Mich.	Ray Nelson	Field	Muckland	Too wet. May rainfall 10 in.
29.	N.Y.	A. G. Newhall	Greenhouse	Muckland	Excessive smut
29.1	N.Y.	Wm. E. Rader	Greenhouse	Muckland	Excessive smut
29.1	N.Y.	Wm. E. Rader	Greenhouse	Muckland	Excessive smut
30.1	Oreg.	P. W. Miller & F.P.McWhorter	Greenhouse	Acid peat	Moderate smut
43.	Wis.	W. J. Hooker & J. C. Walker	Greenhouse	Silt loam	Excessive smut

Results: Ten tests were made by cooperators under the conditions described in Table 30. There was a significant difference in emergence in 9 of the 10 tests (Table 31) and in the percentage of smut infection in 8 of the tests (Table 32). All treatments decisively reduced the severity of smut infection. In half of the tests one or more of the dusts gave better results than formaldehyde, while in the remaining tests formaldehyde was superior. The efficiency of the liquid treatments may have been impaired by heavy rainfall since poor results were reported from Massachusetts where rain fell within 2 hours after planting and from Michigan, New York, and Illinois where exceptionally moist conditions prevailed. Pooling the data by the method of Roessler and Leach showed 5 tests (most of which were greenhouse trials in heavily infested soil under conditions of moderate moisture) to constitute a homogeneous group. In this group, the liquid treatments were slightly more effective than the dusts (Table 33). Of the dust treatments, Fermate used at 100% appeared to give the best smut control. Growers on muckland, however, would prefer a brighter colored dust.

There was evidence in several tests that the lower dosages of dusts were adequate. However, if smut is abundant in the soil, the maximum dosage is to be preferred according to the data (Table 34) furnished by a cooperator who tested Fermate at reduced dosages in a well randomized, replicated greenhouse test employing muck soil. The reduced dosages may be economical in lightly infested fields, but other factors such as depth of sowing, soil type, moisture, and speed of germination would have

Table 31. Effect of treatments for onion smut on the emergence or stands of seedlings approximately a month after sowing.

Report from		Emergence from seed treated with								F	Least sign. diff.	Error
Test no.	State	Fermate 100%	Fermate 75%	Formaldehyde 1%	Thiosan 100%	Thiosan 75%	Catex 2%	Catex 2.5%	Check	value	5% - 1%	var.
10	Ill.	64.4	68.0	60.6	59.4[b]	62.2[b]	54.8	61.1	44.2	6.9	0.8- 1.0	0.37
17.1	Mass.[a]	100.2	101.0	92.3	97.7	100.0	83.9	85.6	78.6	4.1	12.5-16.8	3359.9
19.1	Mich.[a]	51.4	59.7	46.5	51.8[b]	59.2[b]	46.6	51.4	47.3	2.6	18.8-25.5	212.4
28	N.Y.	64.8	74.2	68.2	74.8	63.6	71.0	67.4	57.6	2.4	15.0-20.3	134.9
29.1	N.Y.(a)	83.4	85.8	79.0	85.0	81.6	77.8	81.4	69.4	11.8	4.4- 5.9	11.8
29.1	N.Y.(b)	72.5	73.5	60.3	72.3[b]	69.0[b]	59.5	64.8	53.5	4.2	7.7-10.4	36.5
30.1	Oreg.	89.0	89.4	87.2	90.2	84.6	87.0	88.0	88.8	0.85	NS	18.2
43	Wis.	72.4	68.4	65.8	25.6	22.4	8.0	15.2	15.8	94.9	8.0-10.9	38.9
Totals		598.1	619.1	559.9	556.8	542.6	488.6	514.9	455.2			
Average		74.8	77.4	70.0	69.6	67.8	61.1	64.4	56.9			

[a]Massachusetts data coded by dividing by 6 and Michigan data by dividing by 2, since 600 and 200 seeds, respectively, were sown in each replicate

[b]Arasan used in these tests

Table 32. Mean percentages of onion smut, and significances in 8 experiments.

Report from		Percentage of infection from seed treated with								F	Least sign. diff.	
Test no.	State	Formaldehyde 1%	Fermate 100%	Fermate 75%	Arasan 100%	Arasan 75%	Catex 2%	Catex 2.5%	Check	value	5%	1%
10	Ill.	18.40	9.80	34.20	13.60	38.00	47.80	32.00	61.60	58.8	6.67	8.99
17.1	Mass.	6.70	0.47	0.61	0.55	0.56	5.47	4.69	31.62	69.9	3.66	4.94
19.1	Mich.	13.10	3.70	11.71	3.40	3.03	9.18	10.59	29.36	14.2	6.60	8.91
29	N.Y.	3.37	14.38	22.38	16.20	15.94	6.70	9.28	64.30	98.3	5.64	7.62
29.1	N.Y.(a)	11.72	19.88	21.58	28.96[a]	26.73[a]	5.84	7.11	68.40	45.7	8.55	11.53
29.1	N.Y.(c)	3.20	12.86	15.00	24.14[a]	24.56[a]	8.60	6.60	84.62	44.8	8.67	11.70
30.1	Oreg.	3.09	15.31	16.53	1.29[a]	12.72[a]	7.22	18.50	32.14	1.7	NS	
43	Wis.	51.16	28.32	30.22	48.04[a]	55.40[a]	75.56	65.06	94.76	7.0	24.34	32.83
Average		13.84	13.09	19.03	17.02	22.12	20.80	19.23	58.35			

[a]In these tests Thiosan was used in place of Arasan

Relative scores or values of seed treatments (maximum score = 49)

Formaldehyde 1%	Fermate 100%	Fermate 75%	Arasan 100%	Arasan 75%	Catex 2%	Catex 2.5%	Check
19	20	15	15	12	16	16	0

Table 33. Combined analysis of 5 homogeneous sets of data on onion smut control.

Report from Test no.	State	Treatment: Check	Thiosan 100%	Thiosan 75%	Fermate 100%	Fermate 75%	Formaldehyde 1%	Catex 2%	Catex 2.5%	Total	Error variances
29.1	N.Y.(a)	68.4	28.9	26.7	19.9	21.6	11.7	5.8	7.1	190.1	43.56
29	N.Y.(b)	64.3	16.2*	15.9*	14.4	22.4	3.4	6.7	9.3	152.6	19.01
29.1	N.Y.(c)	84.6	24.1	24.6	12.8	15.0	3.2	8.6	6.6	179.5	44.84
19.1	Mich.	29.4	3.4*	3.0*	3.7	11.7	13.1	9.2	10.6	84.1	26.03
17.1	Mass.	31.6	0.6*	0.6*	0.5	0.6	6.7	5.5	4.7	50.8	8.00
Total		278.3	73.2	70.8	51.3	71.3	38.1	35.8	38.3	657.1	141.44
Av. Mean		55.6	14.6	14.1	10.3	14.3	5.6	7.2	7.6	131.4	28.288

F. value = 223
LDM for Sign.: 5% -- 2.97
1% -- 4.16

* Arasan used in place of Thiosan in these tests.

Table 34. Effect of reduced dosage rates of dust on smut control (W. E. Rader, Ithaca, N.Y.)

Treatment and dosage rates	Mean % smut
Check	84.6
1. Fermate straight 20% by weight	34.1
2. Fermate straight 33.3% by weight	26.1
3. Fermate straight 50% by weight	23.7
4. Fermate straight 100% by weight	12.8
1a. Fermate plus talc 1:4 at 1:1 of seed = 20% Fermate	25.6
2a Fermate plus talc 1:2 at 1:1 of seed = 33.3% Fermate	21.2
Fermate plus talc 1:1 at 3/4:1 of seed = 37.5% Fermate	17.7
3a Fermate plus talc 1:1 at 1:1 of seed = 50% Fermate	15.0
Formaldehyde 1% at 15cc per foot of row	3.2
Catex 2% at 15 cc per foot of row	8.6
Catex 2.5% at 15 cc per foot of row	6.6
LD for Sign.: 5% -- 8.9 1% -- 11.9	

Table 35. Percentage of smut control with Fermate, Arasan, and Thiosan

Seed treatment	Smut infection %
Fermate 100%	14.4
Fermate 75%	22.4
Arasan 100%	16.2
Arasan 75%	15.9
Thiosan 100%	19.1
Thiosan 75%	32.5
Check	64.3

L.D.Sign.: 5% -- 3.7; 1% -- 4.9

to be considered in deciding upon the minimum effective dosage. There is some evidence (Table 34) that a certain amount of talc diluent with Fermate may improve its effectiveness if the dosage is not reduced too much, but more work along this line is needed before arriving at a final conclusion.

In one of the New York greenhouse tests, Thiosan, Arasan, and Fermate were all compared at the 100% and 75% levels. The mean percentages of smut infection are given in Table 35. In this test Fermate appeared significantly better than Thiosan but perhaps not better than Arasan, and reduced dosages of Fermate and Thiosan were significantly less effective. A comparison between the degree of smut control obtained by the cooperators using Arasan and those using Thiosan, when corrected for the different amounts of smut in the 2 groups of checks, indicated that the 2 treatments were not significantly different. This also appeared to be true in field tests conducted on many muckland farms of New York in 1943.

In one of the tests (no. 28) conducted on a muck field where 23% smut infection occurred on untreated seed, emergence was increased over check by all treatments, especially by Thiosan 100% and Fermate 75%. Survival to harvest time was significantly improved by all treatments with Thiosan 100% and formaldehyde, giving significantly better results than either of the Fermate treatments or Thiosan 75%. Catex 2.5% also resulted in better survival than Fermate 100% and Thiosan 75%. Final yields were increased significantly by all treatments (Table 36). Thiosan 100% gave larger increases than Thiosan 75% and Fermate 100%. Formaldehyde gave the second-best yield but the improvement over the remaining treatments was not significant. In this and the only other test (no. 10) where yield records were taken, Thiosan seemed to be fully as good as formaldehyde (Table 36).

Table 36. Yield of onions (pounds per 10 feet of row) from 2 seed treatment tests.

Report from:		Yield of marketable onions									L.D. sign.	
Test no.:	State	Check	Thiosan 100%	Thiosan 75%	Fermate 100%	Fermate 75%	Formaldehyde 1%	Catex 2%	Catex 2.5%	F value	5%	1%
10	Ill.	6.3	23.4*	18.1*	23.4	13.9	22.5	9.3	18.4	12.0	5.3	7.1
28	N.Y.	3.7	10.6	7.3	7.5	8.1	10.2	8.7	9.0	85.0	3.0	4.1
Totals		10.0	34.0	25.4	30.9	26.0	32.7	18.0	27.4			
Average		5.0	17.5	12.7	15.4	13.0	16.3	9.0	13.7			

* Arasan used in this experiment.

In Oregon, Calomel at 100% and a mixture of Calomel-Fermate at 100% were included in a test on acid peat. Neither gave appreciable control over the check.

Discussion of Smut Control Tests

1. It is difficult to draw valid conclusions as to which treatment was superior because of variation in results in different localities.

2. It is probably safe to say that no treatment consistently showed ability to control smut better than liquid formaldehyde under all conditions, but that under certain conditions Catex did nearly as well, and both dusts at the heavier rates of application gave yields equal to those obtained with formaldehyde.

3. If rain falls soon after sowing, dust treatments apparently suffer less than liquid treatments from the resulting dilution.

4. The dust seed treatments were practically as effective as liquid treatments except where the smut infestation was abnormally severe, as in greenhouse soils. The reduced dosages of dusts seemed to be particularly inadequate under these conditions. Careful tests should be run before recommending seed treatment at a dosage of less than 100%.

5. The expense of dust treatments operates against their adoption on farms where seed is shown at very heavy rates (60 to 90 lbs. per acre), but the convenience of sowing dust-treated seed may give it a place on farms where bulbs are grown for table use and liquid treatment is especially objectionable.

B. Damping-Off Control

Five tests were made under the conditions described in Table 37 with the following treatments: Thiosan 2%, Fermate 1.5%, Spergon 2%, Semesan 0.25%, yellow Cuprocide 1%, and zinc oxide 4%. Significant differences were obtained between treatments in 4 of the 5 tests as shown in Table 38.

Table 37. Cooperators and conditions in onion seed treatment tests for damping-off control.

Code no.	Locality	Cooperator	Location of test	Soil type	Notes
06	Ga.	W. D. Moore	Field	Sandy loam	500 seed replicates
06A	Ga.	W. D. Moore	Field	Sandy loam	500 seed replicates
14	Iowa	R. H. Porter	Greenhouse	Sand	4 replicates
17	Mass.	E. F. Guba & E.V.Seeler, Jr.	Field	Gravelly loam	Used Catex also
45	Brit.Col.	Irene Mounce	Greenhouse	Compost	

In 1 outdoor test at Waltham, Massachusetts, Arasan was substituted for Thiosan, Yellow Cuprocide was left out, and formaldehyde 1%, Catex 2%, and Catex 2.5% were added as soil treatments. The liquid treatments gave no control, Fermate and Semesan increased the stand significantly, while zinc oxide and Arasan very nearly did. The failure of Catex to control damping-off is in line with similar tests conducted at Cornell

Table 38. Mean stands of onions in 5 seed treatment tests for damping-off control.

Report from	Stands from seed treated with							F	L.S. diff.	
Test no.	Locality	Thiosan	Fermate	Yellow Cuprocide	Semesan	Zinc oxide	Spergon	Check	value	5%	1%
06	Ga.*	184.1	182.7	183.8	177.7	168.1	168.0	168.4	1.5	NS	
06a	Ga.*	281.7	230.7	221.9	209.3	229.3	201.2	208.1	3.5	49.0	66.0
14	Iowa	90.5	86.0	88.2	81.2	83.2	79.0	63.5	6.4	9.4	12.8
17	Mass.	82.4	87.0	+86.5	84.6	83.4	+82.8	78.4	4.6	5.9	8.0
45	Brit.Col.	88.0	88.6	83.0	83.6	69.8	70.0	65.6	13.1	7.7	10.5
Average		145.3	135.0	132.7	127.3	126.7	120.2	116.8			
Relative scores of treatments		11	5	5	4	1	1	0	Maximum score =	24	

* In Georgia 500 seed samples were sown per replicate.

+ Figures for Yellow Cuprocide and Spergon were missing in this experiment and were supplied for this table by treating part of it as a randomized block after the method of Love, which makes them only approximations.

where its use as a soil drench for this purpose has not met with success.

Conclusions on Damping-off Control Tests

Thiosan 2% appeared to control damping-off better than the other materials, although Fermate 1.5% did as well in 3 of the 4 tests in which significant differences occrred. Yellow Cuprocide was a close third, its efficacy not being significantly below that of Fermate. A glance at Table 31 indicates that Fermate may be slightly better than the other treatments also.

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X. POTATO SEED DISINFECTANTS

C. N. Clayton

Results from the 1942 cooperative tests on disinfection of potato seed tubers indicated that treatment with mercurial compounds frequently failed to increase stands or yields and that an effective non-injurious treatment was needed.

In 1943 the objective was to determine the relation of various mercurial and organic toxicants as disinfectants of seed potatoes to stand, control of Rhizoctonia, seedpiece-decay, green weight of plants, and yield. Cooperators located in 11 States made 15 cooperative field trials. The cooperators were: M. B. Linn, Illinois; R. W. Samson, Indiana; C. V. Kightlinger, Massachusetts; R. S. Davidson and C. J. Eide, Minnesota; J. A. Pinckard, Mississippi; G. L. McNew, New York; J. H. McLaughlin and H. B. Cordner, Oklahoma; F. L. Howard, Rhode Island: C. N. Clayton, South Carolina; C. J. Gould and T. E. Randall, Washington; and G. H. Starr, Wyoming.

Each cooperator applied 5 assigned treatments and 3 unassigned treatments (of the cooperator's choice) to whole tubers of certified seed of the variety suited to his locality. Unless stated otherwise, the treatments were applied by immersing the tubers for approximately 1 minute in an aqueous solution or suspension of 1 pound of treating material in 7-1/2 gallons of water.

The treatments were: (1) no treatment (control); (2) Semesan Bel; (3) Yellow oxide of mercury 2oz. to 7-1/2 gals. water; (4) Wettable Spergon; (5) Fermate; (6), (7), and (8) unassigned.

Three of the following treatments were chosen as unassigned treatments by each cooperator:

(a) Thiosan
(b) Mercuric chloride, 1 oz. to 7-1/2 gals. water, 90 min. soak
(c) Mercuric chloride, 1-1/2 oz., plus commercial Hydrochloric acid, 0.6 pint to 7-1/2 gals water, 5 min. soak.
(d) Wettable Sulfur, Stauffer's Magnetic-Spray (98%S), 15 lbs. to 7-1/2 gals. water.
(e) Formalin (40% formaldehyde) 0.4% by volume, 90 min. soak.
(f) USR #604 (20% dichloro-naphthoquinone), 1-1/2 lbs to 7-1/2 gals.
(g) Quartol (dimethyl ethanol octodecylammonium chloride), 0.02% by volume.
(h) DL1 (dimethyl di(dodecyl) ammonium chloride), 0.02% by volume.
(i) Imularv (dimethyl benzyl dodecyl ammonium chloride, 20% aqueous solution) 5.0% by volume.
(j) Sanosced Potato Dip (7.9% ethanol mercuric chloride).
(k) Sinox (sodium dinitro ortho cresol) 2% by volume.
(l) Sinox 1% by volume, 10 min. soak.
(m) Sulfur dust.

Following treatment, the tubers were allowed to dry. In some tests the tubers were cut into seedpieces and planted promptly after treatment, whereas in other tests several weeks elapsed before planting.

In each test a randomized block was used with 5 replicates of each treatment. Each plot consisted of a single 50-foot row and contained 50 seedpieces for yield and stand data plus an additional 10 seedpieces for data on seedpiece decay, Rhizoctonia infection of the plant stems, and green weight per plant. The data from the extra 10 seedpieces in each plot were obtained by removing and examining the plants when they were about 8 inches tall.

In Table 39 are given test number, location, variety, stage of sprout development when treated, percentage of seedpices with Rhizoctonia sclerotia and with scab lesions on the surface, dates of treating, planting, and harvesting, and soil type, reaction, and moisture condition at planting.

Table 39. Location, variety, and environmental conditions of potato seed treatment tests -- 1943

Report from: Test no.	State	Variety	Seedpieces with Rhizoctonia	Seedpieces with Scab	Date Treated[a]	Date Planted	Date Harvested	Soil Moisture	Soil Type	Soil pH
			%	%						
13	Ill.	Irish Cobbler	35	40	4/2	5/1	9/30	Opt.	Cky loam	6.1
15	Ind.	Katahdin	95	5	5/13	6/11	10/7	Opt.	Silt loam	6.0
15a	Ind.	Katahdin	95	5	5/13	6/15	10/16	Opt.	Muck	5.2
23	Mass.	Chippewa	46.5	28.5	5/10	5/14	Oct.	Opt.	Merrimac	5.3
25	Minn.	Early Ohio	0.5	1.8	4/13	4/16	8/3	Opt.	Loamy sand	5.8
25a	Minn.	Bliss Triumph	50	0	5/8	5/10	9/23	Opt.	Silt loam	--
25b	Minn.	Red Warba	0	0	5/22	6/7	9/16	Opt.	Clay loam	--
28	Miss.	---	18.5	--	--	Late	--	--	---	6.7
28a	Miss.	---	18.5	--	--	Late	--	--	---	5.5
36	N.Y.	Katahdin	15	6	5/20	6/10	10/4	Opt.	Silt loam	7.3
42	Okla.	Bliss Triumph	44.5	3.5	3/5	3/12	6/24	Dry	Sandy loam	5.3
45	R.I.	Irish Cobbler	5	<1	4/21	5/17	8/27	Wet	Sandy loam	5.2
46	S.C.	Irish Cobbler	13	4	2/11	2/12	5/27	Opt.	Sandy loam	5.9
53	Wash.	White Rose	35.5	66	4/29	5/1	9/15	Opt.	Sandy loam	--
58	Wyo.	Bliss Triumph	50	50	--	--	--	--	---	--

At time of treating, eyes of tubers were dormant in tests 36 and 45; sprouts were just starting in tests 23 and 25; 1/8 in. long in 15, 15a, 25b, 42, and 46; and 1/4 in. long in tests 13 and 53. Whole tubers were used in tests 15 and 45.

[a]No injury from treatment occurred except that in test 13 mercuric chloride caused delayed sprouting and in test 23 some pitting of surface of tuber; and in tests 28 and 28a Sinox injured the sprouts.

Table 40. Relation of disinfection of seed potatoes to percentage of seedpieces producing plants -- 1943

Report from Test no.	State	Mean percentage stand from seedpieces treated with: Control	Semesan Bel	HgO	Wet. Spergon	Fermate	Thiosan	Wet. Sulfur	$HgCl_2$	HCl	$HgCl_2$	[a] Unassigned	Diff. req. sign.	Calc. "F" value
15	Ind.	98.4	96.4	98.8	97.2	98.4	98.8	96.8	--	--	--	e=84.4	4.9	8.02
23	Mass.	95.2	94.4	94.0	88.0	96.0	--	--	76.0	82.8	--	j=88.8	7.3	7.7
25a	Minn.	95.2	96.0	94.0	92.0	92.2	93.6	93.6	86.0	--	--	--	4.6	3.85
36	N.Y.	90.0	89.2	83.6	92.0	94.4	87.2	88.4	--	--	--	f=83.6	7.9	2.63
46	S.C.	98.2	89.8	94.0	96.0	96.0	96.0	--	90.6	--	--	i=87.2	5.4	4.21
53	Wash. [b]	55.4	54.6	55.0	49.0	56.6	55.8	--	--	50.4	--	m=55.6	3.8	4.47
13	Ill.	69.2	59.6	59.6	58.4	61.6	56.8	--	62.4	--	--	e=64.0	NS	0.85
15a	Ind.	96.4	93.6	94.0	91.6	93.6	93.2	94.8	--	?	--	e=93.6	NS	0.64
25	Minn.	88.4	93.6	93.6	91.6	92.4	93.6	91.2	90.4	--	--	--	NS	0.30
25b	Minn.	82.4	88.8	91.6	86.4	79.6	83.6	71.6	84.8	--	--	--	NS	0.49
42	Okla.	91.2	89.6	91.2	95.2	89.6	91.2	--	--	92.4	e=86.0		NS	1.95
45	R.I.	100.0	100.0	99.2	99.6	99.6	100.0	--	--	--	g=99.6 h=99.6		NS	0.64
58	Wyo.	96.0	98.0	99.2	99.2	99.6	98.0	99.2	--	--	e=98.4		NS	1.41
Average for sign. tests except 53		95.4	93.2	92.9	93.0	95.4	--	--	--	--	--	--		

[a] See page 46 for treatments indicated by the letters

[b] Average no. of plants from 50 seedpieces per plot rather than percent of seedpieces producing plants.

Table 40A. Number of tests in which the average percentage stand for any one treatment is significantly higher than that for each other treatment, and relative value of the treatments for the significant tests.

Treatment	Number of tests in which the treatment in the first column is better than: Control	Semesan Bel	HgO	Wettable Spergon	Fermate	Relative value of treatments [a]
Control	--	1	0	1	0	2
Semesan Bel	0	--	0	1	0	1
Yellow oxide of mercury	0	0	--	1	0	1
Wettable Spergon	0	1	1	--	0	2
Fermate	0	1	1	2	--	4

[a] Maximum value for any treatment is 20

Table 41. Relation of disinfection of seed potatoes to control of Rhizoctonia lesions on stems of plants -- 1943

Report from:		Mean Rhizoctonia index[a]										Diff.	Calc.
Test no.?	State:	Con-trol	Semesan Bel	HgO	Wet. Spergon	Fermate	Thiosan	Wet. Sulfur	$HgCl_2$	$HgCl_2$	[b]Unassigned:	req. sign.	"F" value
13	Ill.	0.22	0.13	0.22	0.23	0.22	0.25	--	0.10	--	e=0.056	0.096	48.9
15a	Ind.	0.47	0.11	0.03	0.41	0.53	0.47	0.39	--	--	e=0.608	0.122	22.1
36	N.Y.	1.08	1.14	0.97	0.63	0.24	0.43	1.05	--	--	f=0.809	0.557	3.0
45	R.I.	0.23	0.13	0.15	0.28	0.33	0.30	--	--	--	g=0.42 h=0.30	0.158	3.1
53	Wash.	0.31	0.14	0.40	0.25	0.20	0.44	--	--	0.09	m=0.330	0.204	3.1
23	Mass.	0.78	0.38	0.52	0.93	0.35	--	--	0.73	1.15	j=0.534	NS	2.0
25	Minn.	0.16	0.12	0.17	0.15	0.17	0.18	0.21	0.12	--	---	NS	1.8
25a	Minn.	0.26	0.13	0.16	0.26	0.23	0.16	0.24	0.14	--	---	NS	2.3
25b	Minn.	0.20	0.20	0.20	0.20	0.17	0.22	0.20	0.21	--	---	NS	0.3
42	Okla.	0.40	0.25	0.35	0.29	0.36	0.34	--	--	0.32	e=0.274	NS	0.9
46	S.C.	0.04	0.00	0.00	0.00	0.00	0.01	--	0.00	--	i=0.030	NS	2.2
Average for sign. tests:		0.46	0.33	0.36	0.36	0.30	0.38						

[a]Each of 10 plants per plot, according to the amount of Rhizoctonia infection of stem or rhizomes, was assigned into one of 5 classes: 0=no infection; 1=slight shallow reddish discoloration; 2=considerable shallow reddish lesions; 3=sunken lesions; 4=complete girdling or decay of stem or rhizomes. Rhizoctonia index for each plot calculated by multiplying the number of plants in each class by the number of the class, total those products and divide by 4x the number of plants examined.

[b]See page 46 for treatments indicated by the letters.

Table 41A. Number of tests in which the mean Rhizoctonia index for one treatment is significantly less than that for each other treatment, and relative value of the treatments for the significant tests.

Treatment	Number of tests in which the treatment in the first column was better than: Control	Semesan Bel	HgO	Wettable Spergon	Fermate	Thiosan	Relative value of treatments[a]
Control	--	0	0	0	0	0	0
Semesan Bel	2	--	1	2	3	4	12
Yellow Oxide of mercury	1	0	--	1	2	2	6
Wettable Spergon	0	0	0	--	0	0	0
Fermate	1	1	1	0	--	1	4
Thiosan	1	1	0	0	0	--	2

[a]Maximum value for any treatment 25

Table 42. Relation of disinfection of seed potatoes to seedpiece decay -- 1943

Test no.	State	Percentage of seedpiece decay from seed treated with: Control	Semesan Bel	HgO	Wet. Spergon	Fermate	Thiosan	Wet. Sulfur	$HgCl_2$	HCl	$HgCl_2$	[a]Unassigned	Diff. req. sign.	Calc. "F" value
13	Ill.	12.0	2.0	10.0	20.0	26.0	10.0	--	10.0	--	--	e=14.0	11.8	3.18
15a	Ind.	10.6	6.0	0	11.0	2.0	6.6	36.4	--	--	--	e= 2.2	7.4	21.1
25a	Minn.	28.0	14.0	2.0	12.0	8.0	36.0	68.0	4.0	--	--	--	19.4	10.7
25b	Minn.	21.6	0.8	3.2	14.8	0.4	1.2	30.2	2.0	--	--	--	5.9	32.1
36	N.Y.	62.0	46.0	30.2	69.4	66.6	80.0	73.0	--	--	--	f=71.6	22.3	4.5
23	Mass.	4.6	4.4	7.4	8.0	6.6	--	--	15.4	16.0	j= 7.2		NS	0.9
42	Okla.	0	2.0	4.0	4.0	4.0	10.0	--	--	0	e= 2.0		NS	0.6
45	R. I.	0	0	0.0	2.0	2.0	0	--	--	--	g= 0 h= 0		NS	0.3
46	S.C.	0	0	0	0	0	6.0	--	--	--	i= 0		NS	1.0
Average for sign. tests:		26.8	13.8	9.1	25.4	20.6	26.7	51.9						

[a]See page 46 for treatments indicated by the letters

Table 42A. Number of tests in which the average percentage seedpiece decay for one treatment is significantly less than that for each other treatment, and relative value of the treatments for the significant tests.

Treatment	Number of tests in which the treatment in the first column was better than: Control	Semesan Bel	HgO	Wettable Spergon	Fermate	Thiosan	Wettable Sulfur	Relative value of treatments[a]
Control	--	0	0	0	1	0	3	4
Semesan Bel	1	--	0	2	1	2	4	10
Yellow oxide of mercury	4	0	--	3	2	2	4	15
Wettable Spergon	1	0	0	--	0	1	3	5
Fermate	3	0	0	2	--	1	3	9
Thiosan	1	0	0	1	1	--	3	6
Wettable Sulfur	0	0	0	0	0	0	--	0

[a]Maximum value is 29 for any treatment except Wettable Sulfur for which it is 24

Table 43. Relation of disinfection of seed potatoes to green weight of plants, 1943

Report from: Test no.	State	Mean green-weight (grams) per plant[a] Control	Semesan Bel	HgO	Wet. Spergon	Fermate	Thiosan	Wet. Sulfur	$HgCl_2$ HCl	$HgCl_2$	Unassigned	Diff. req. sign.	Calc. "F" value
25	Minn.	31.7	36.2	34.4	30.9	30.0	30.9	31.7	28.1	--	--	4.55	2.62
25b	Minn.	48.3	63.0	55.6	56.3	65.5	55.6	48.3	62.2	--	--	8.15	5.0
36	N.Y.	192.9	194.9	199.5	251.1	207.2	200.3	207.2	--	--	f=219.1	28.6	3.67
42	Okla.	52.8	79.6	57.2	75.2	55.8	63.8	--	--	69.2	e= 70.8	15.1	3.49
45	R.I.	89.7	72.5	61.6	94.2	95.1	94.2	--	--	--	g=100.6 h=103.3	18.5	5.0
46	S.C.	43.9	38.5	33.5	48.0	46.7	48.5	--	37.1	--	i= 35.3	9.5	3.25
13	Ill.	18.2	19.9	18.7	18.5	21.2	19.1	--	22.9	--	e= 20.2	NS	0.5
23	Mass.	37.0	35.3	41.4	41.4	42.6	--	--	43.7	40.9	j= 40.9	NS	0.2
25a	Minn.	43.6	50.0	59.0	51.8	53.6	47.0	45.3	47.0	--	--	NS	1.3
53	Wash.	64.9	53.9	46.5	55.0	57.3	55.8	68.6	--	45.4	--	NS	1.7
Average for sign. tests:		76.6	80.8	73.6	92.6	83.4	82.2						
Average for all tests		62.3	64.4	60.7	72.2	67.5	--						

[a] Green-weight of plants, without attached seedpieces, that were removed for data on Rhizoctonia infection

Table 43A. Number of tests in which the mean green-weight of plants for one treatment is significantly greater than that for each other treatment and relative value of the treatments for the significant tests.

Treatment	No. of tests in which the treatment in first column is better than: Control	Semesan Bel	HgO	Wettable Spergon	Fermate	Thiosan	Relative value[a] of treatments
Control	--	1	2	0	0	0	3
Semesan Bel	2	--	1	1	2	2	8
Yellow oxide of mercury	0	0	--	0	0	0	0
Wettable Spergon	2	4	3	--	2	1	12
Fermate	1	1	3	0	--	1	6
Thiosan	0	2	2	0	0	--	4

[a] Maximum value for any treatment is 30

Table 44. Relation of disinfection of seed potatoes to yield of U.S.No. 1 tubers -- 1943.

Report from Test no.	State	Average yield (lbs.) of No. 1 potatoes: Control	Semesan Bel	HgO	Wet. Spergon	Fermate	Thiosan	Wet. Sulfur	$HgCl_2$ HCl	$HgCl_2$	[a]Unassigned	Diff. req. sign.	Calc. "F" value
25b	Minn.	43.7	53.0	41.2	39.3	47.2	44.3	34.0	46.0	--	--	10.2	2.57
28	Miss.	6.6	6.1	4.1	6.9	3.7	--	--	--	4.5	k= 0.7: l= 1.0	5.3	16.86
28a	Miss.	11.4	7.2	10.7	12.9	16.8	--	--	--	10.5	k= 1.2: l= 1.9	8.5	42.60
36	N.Y.	32.8	34.9	38.5	28.6	29.1	29.1	32.3	--	--	f=34.1	5.2	3.69
42	Okla.	14.5	12.5	14.1	17.9	12.2	15.0	--	--	19.5	e=14.0	3.2	5.19
53	Wash.	11.5	12.9	13.3	9.7	5.7	3.8	--	--	7.0	m= 8.1	5.6	3.17
13	Ill.	1.7	1.4	1.8	2.1	1.8	1.3	--	1.7	--	e= 2.0	NS	0.9
15	Ind.	27.1	25.0	26.8	25.3	25.5	26.3	24.8	--	--	e=24.0	NS	0.6
15a	Ind.	34.8	34.7	31.7	37.3	33.2	29.9	35.1	--	--	e=36.6	NS	0.76
23	Mass.	57.7	62.4	59.4	53.9	58.1	--	--	63.5	53.3	j=53.9	NS	0.36
25	Minn.	94.0	94.4	98.8	101.1	90.0	92.4	104.8	84.7	--	--	NS	1.04
25a	Minn.	34.3	34.9	35.8	32.0	33.5	30.1	34.2	34.0	--	--	NS	0.65
45	R.I.	22.2	21.3	23.2	21.0	22.7	21.2	--	--	--	g=22.6 h=24.9	NS	1.70
46	S.C.	31.4	29.8	30.1	29.2	27.6	29.8	--	26.0	--	i=27.5	NS	1.06
58	Wyo.	53.2	52.8	55.6	55.6	50.4	51.4	49.4	--	--	e=55.8	NS	1.03
Average for sign. tests:		20.1	21.1	20.3	19.2	19.1	--	--	--	--	--		
Average for non-sign. tests		39.3	39.6	40.4	39.7	38.1	--	--	--	--	--		
Average for all tests		31.8	32.2	32.3	31.5	30.5	--	--	--	--	--		

[a]See page 46 for treatments indicated by the letters

Table 44A. Number of tests in which the average yield for one treatment is significantly better than that for each other treatment, and relative value of the treatments for the significant tests.

Treatment	Number of tests in which the treatment in the first column was better than: Control	Semesan Bel	HgO	Wettable Spergon	Fermate	Thiosan	Relative value of treatments[a]
Control	--	0	0	0	1	1	2
Semesan Bel	0	--	1	2	2	2	7
Yellow oxide of mercury	1	0	--	1	2	2	6
Wettable Spergon	1	1	1	--	1	1	5
Fermate	0	1	0	0	--	0	1
Thiosan	0	0	0	0	0	--	0

[a]Maximum value is 28 for any treatment except Thiosan for which it is 20

Effect of Seed Treatment on Stand of Plants. Table 40 contains a summary of the stand data from 13 tests after they had been analyzed as randomized block experiments. Only 6 of the 13 tests were significant at the 5% point. The data of final stand counts in Table 40 are summarized in Table 40A to show in how many of the 6 significant tests each assigned treatment is significantly better than each other treatment and also to indicate the relative values of the treatments in affecting stands. The relative values obtained by totaling the number of tests in which the individual treatments were significantly better than the other treatments indicate that no treatment was significantly better than the control in any test, and that Semesan Bel, yellow oxide of mercury, Spergon, and Fermate did not differ greatly in their effect upon stand. It should be noted that in several of the tests in which mercuric chloride or acid-mercuric chloride was used a significant reduction in stand resulted in comparison with the untreated control.

Since early stand counts record more clearly any delay in emergence that may result from treatment than do final stand counts, such data were taken in tests 25, 25a, 25b, 42, and 46. Only 2 of the 5 tests were significant. Acid-mercuric chloride and yellow oxide of mercury in both tests, and Semesan Bel, Fermate, and Imularv in one test, had significantly lower stands than did the untreated.

Effect of Seed Treatment on Rhizoctonia Stem Infection. Data on Rhizoctonia infection (Table 41) on the stems of plants from 10 seedpieces from each plot were taken in 11 tests, 5 of which were significant. The Rhizoctonia control data are summarized in Table 41A to show in how many of the 5 significant tests each treatment is significantly better than each other treatment and also to indicate the relative values of the treatments in controlling Rhizoctonia infection. A significant reduction in Rhizoctonia infection was attained in 2 tests with Semesan Bel and in 1 test each with yellow oxide of mercury, Fermate, and Thiosan.

Effect of Seed Treatment on Seedpiece Decay. Data on seedpiece decay (Table 42) were taken on the 10 seedpieces per plot that were removed for the Rhizoctonia-control data. Five of the 9 tests were significant. The summarized data (Table 42A) show that yellow oxide of mercury and Semesan Bel were the most effective treatments in reducing the amount of seedpiece decay, whereas Wettable Sulfur increased it.

Effect of Seed Treatment on Green Weight of Plants. Since disease control, injury, or stimulation by treatment could be reflected in the green weight of the plants, such data (Table 43) were taken in 10 tests on the plants removed for data on Rhizoctonia infection. Data from 6 of the 10 tests were significant and are summarized in Table 43A. The data seem to indicate that Wettable Spergon may have been stimulatory, for the increase in green weight per plant from its use can not be attributed to Rhizoctonia control as might be the case with Semesan Bel.

Effect of Seed Treatment on Yield. The yield data for the 15 tests, 6 of which are significant, are summarized in Tables 44 and 44A. Among the reasons for low yields in several tests were late planting, drought, or insect damage. In only 2 tests did any treatment significantly increase the yields of No. 1 tubers in comparison with the control. In test 42 Spergon and mercuric chloride were better than the control and in test 36 yellow oxide of mercury was better. The relative values for Semesan Bel,

Table 45. Relation of disinfection of seed potatoes to control of Rhizoctonia and scab on tubers -- 1943

Report from: Test no.	State	Rhizoctonia	Scab: "F" value	Scab: Diff. req. sign.	Scab index[a]	
13	Ill.	None	1.7	NS		
15	Ind.	None	8.1	2.7	Control	0
					Semesan Bel	5.2
					HgO	5.1
					Spergon	0.5
					Fermate	2.0
					Thiosan	1.0
					Formalin	6.8
					Wet. Sulfur	0.2
15a	Ind.	Slight to moderate infestation of small sclerotia on all tubers	4.4	4.7	Control	10.1
					Semesan Bel	10.3
					HgO	11.9
					Spergon	5.4
					Fermate	3.9
					Thiosan	4.2
					Formalin	8.5
					Wet. Sulfur	3.2
23	Mass.	Not significant	1.7	NS		
25	Minn.	None	Slight scab on tubers from all plots			
28	Miss.	None	Uniformly serious			
28a	Miss.	None	Uniform on all tubers			
25b	Minn.	Not significant		NS		
36	N.Y.	None	Trace of scab on tubers from all plots			
42	Okla.	None	No scab			
45	R.I.	"F" value 3.08; only HgO and DL1 sign. better than control	1.01	NS		
46	S.C.	None	No scab			
53	Wash.	Not significant "F" value 1.9	No scab			

[a]The scab index for tests 15 and 15a was calculated by dividing the yield of each plot into scab-free, slightly, moderately, and severely scabbed classes; assigning numerical values of 0, 1, 2, or 3 to those classes; then multiplying the weight of tubers in each class by the class value. The sum of the resulting values was then divided by 3 x the total weight of tubers examined and then multiplied by 100.

yellow oxide of mercury, and Wettable Spergon were slightly higher than that for the control, Fermate, or Thiosan.

Effect of Seed Treatment on Amount of Rhizoctonia and Scab on Tubers. Data on Rhizoctonia control on tubers (Table 45) were taken at harvest by assigning the lot of potatoes from each plot, according to the estimated amount of tuber surface covered with sclerotia of the fungus, into one of the following classes: 0, no sclerotia; 1, a trace; 2, slight; 3, moderate; or 4, severe. Sclerotia on tubers were reported in 5 of 11 tests. In only 1 test did any treatment significantly reduce the amount of Rhizoctonia; in that test yellow oxide of mercury caused the reduction.

Data on control of common scab (Table 45) were taken at harvest by assigning the lot of potatoes from each plot, according to the estimated amount of tuber surface covered with scab lesions, into the following classes: 0, no scab; 1, a trace; 2, slight; 3, moderate; or 4, severe. Scab infection occurred in 10 of 13 tests. However, scab infection data were significant only in the 2 tests from Indiana, scab being significantly reduced by Spergon, Fermate, Thiosan, or Wettable Sulfur in one test and significantly increased by Semesan Bel, yellow oxide of mercury, or formalin in the other. The yield of scab-free No. 1-size tubers for Wettable Spergon in test 15a was significantly higher than for the control, Semesan Bel, yellow oxide of mercury, or Thiosan. In test 15 the yield of scab-free No. 1-size potatoes for the control was the highest of any treatment although only that for formalin was significantly lower than the control.

Summary of Potato Seed Treatment Data for 1943. Summarizing, the data indicate that for yield the relative value of Semesan Bel, yellow oxide of mercury, or Wettable Spergon was only slightly higher than that of the control; for stand, the untreated control was best; for control of seed-piece decay, yellow oxide of mercury was highest, Semesan Bel and Fermate being next; for control of Rhizoctonia on stems, Semesan Bel was highest, yellow oxide of mercury and Fermate being next; for green weight per plant, Wettable Spergon was highest, Semesan Bel and Fermate next in order.

In general, the data tend to support the results of the 1942 trials, which indicated that disinfection of seed potatoes is frequently not profitable.

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XI. SNAP BEAN SEED TREATMENTS

J. C. Walker and W. W. Hare

Seed of Green Refugee beans were treated in a rotary seed treater with the following materials: Spergon at 0.2% (0.5 oz. per 15 lbs. of seed); Fermate at 0.2%; and Arasan at 0.125%.

Five replications of 100 seed each from these treated lots and from an untreated control were sown under field conditions in the localities described in Table 46. The planting dates, soil type, reaction, and moisture at time of planting, precipitation, minimum and maximum daily temperatures from planting to average date of emergence, and average number of days from planting to emergence are also given in Table 46.

Table 46. Location, time, and environmental conditions of green bean seed treatment tests in 1943.

Report from Test no.	State	Planting date	Soil: Type	Soil: pH	Soil: Moisture	Rainfall	Air temperature: Min.	Air temperature: Max.	Days to emerge
						In.	°F.		
11	Ga.	5/8	Clay	5.6	Dry	2.08	43	98	13
28c	Miss.	4/2	Ocklocknee	5.7	Opt.	0.87	43	89	8
52	Wash.	5/19	Sandy loam	5.7	Dry	0.83	37	76	--
28b	Miss.	4/21	Sandy loam	6.7	Opt.	0	39	85	6
6	Fla.	1/29	Fine sandy loam	6.5	Opt.-dry	0.28	28.3	83.4	11
36	N.Y.	6/16	Silt loam	7.3	Dry	1.74	59	96	13
57b	Wis.	4/21	Silt loam	6.2	Opt.	1.38	28	81	19
12	Idaho	5/21	Silt loam	6.9	Opt.	--	38	76	9
57a	Wis.	5/20	Silt loam	6.2	Very wet	0.43	46	80	8
51	Va.	5/6	Silt loam	5.9	Opt.	2.49	54	96	11
28a	Miss.	4/1	---	--	Dry	0.06	48	88	10
22	Mass.	5/6	Sandy loam	5.9-6.0	Opt.	2.42	34	85	13
44	Pa.	5/6	Clay loam	6.8	Opt.-dry	2.65	42	86	9
47	S.C.	4/22	Sandy loam	5.8	Opt.	1.61	42	88	7
17	Iowa	5/8	Clay loam	6.8-7.2	Opt.	--	---		--

In Table 47 are the data from the various localities showing the average number of seedlings for each treatment, calculated F value, and the minimum difference in the means required for significance. It may be seen that there were significant differences in only 3 of the 15 tests and each treatment was significantly better than the check in 2 of the 3 locations.

Table 47. Summary of individual seed treatment tests with Green Refugee beans; analyzed as randomized block tests.

Test no.	Average number of seedlings: Spergon	Fermate	Arasan	Check	Calculated: F value	MSD
11	52.8	52.0	55.8	56.8	---	NS
28c	48.2	55.8	54.2	49.2	0.82	NS
52	76.4	74.0	74.0	74.4	0.09	NS
28b	70.4	72.6	70.0	63.4	1.05	NS
6	75.8	79.0	70.6	82.0	2.14	NS
36	71.4	74.6	78.6	71.8	1.34	NS
57b	65.2	64.2	67.0	61.0	0.91	NS
12	77.6	81.2	82.8	78.0	1.07	NS
57a	79.2	79.4	83.8	81.4	0.94	NS
51	85.2	86.2	86.0	87.6	0.26	NS
28a	87.8	91.2	89.0	88.6	0.781	NS
22	84.8	88.4	87.6	81.4	4.13	4.8
44	89.2	87.4	89.2	83.0	3.58	4.75
47	93.8	88.4	85.4	83.8	11.2	4.05
17	83.0	83.4	86.6	84.0	2.55	NS

Table 48. Summary of group analyses of tests with Green Refugee beans in 1943.

No. of locations	Average number of seedlings: Spergon	Fermate	Arasan	Check	Average error var.	F value	MSD
14	77.71	78.63	78.91	76.76	35.20	1.887	NS

In Table 48 are the data from a group analysis of the combined tests (method of E. B. Roessler and L. D. Leach). When test 11 was omitted the remaining 14 tests formed a homogeneous group. It may be seen that there were no significant differences in the combined analysis.

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XII. CUCUMBER SEED TREATMENTS

S. P. Doolittle

The cucumber trials were conducted in 8 States. The seed was treated with Yellow Cuprocide (1.5%), Arasan (0.3%), and Spergon (0.3%). (All percentages are by weight of seed). Four of the trials were made in the greenhouse and 5 in the field. Data were based on total emergence and 7 of the 9 tests gave significant results. The other 2 tests were lost through weather and insect damage.

Table 49. Location, time, and environmental conditions for 9 cooperative cucumber seed treatment tests conducted in 1943

Report from: Test no.	State	Planting date	Soil conditions: pH	Moisture	Soil type	Rainfall	Air temperature: Max.-Min.	Days to emerge
						in.	°F.	
13	Ill.	4/21[a]	--	Wet	Sandy loam	--	--	5
20.1a	Md.	4/8[a]	5.8	Opt.	Sandy loam	--	89-60	6
20.1b	Md.	4/28[a]	5.8	Opt.	Sandy loam	--	90-67	5
24	Mich.	6/1	6.8-7.2	Opt.	Sandy loam	--	--	6
31	N.J.	7/17	5.6	Opt.-dry	Sassafras loam	0.39	92-61	5
36	N.Y.	6/19	7.4-7.9	Opt.	Silt loam	0.96	96-46	9
44	Pa.	5/17	6.2	Opt.	Clay loam	1.97	89-50	11-13

[a]Planted in greenhouse

Table 50. Effect of seed treatment on emergence of cucumber seedlings.

Report from: Test no.	State	Emergence from seed treated with: Yellow cuprocide	Semesan	Arasan	Spergon	Untreated check	Least sign. diff.[a]	Calculated "F" value
		%	%	%	%	%		
13	Ill.[b]	73.4	68.0	79.6	62.6	42.2	8.68	24.38
20.1	Md.[b]	79.8	78.8	83.2	81.6	62.8	4.56	29.67
20.1a	Md.[b]	71.0	74.6	71.8	69.2	56.2	7.48	8.27
24	Mich.	25.8	23.6	24.8	23.2	12.8	8.13	3.76
31	N.J.	62.5	57.4	65.8	63.4	57.6	6.40	3.02
36	N.Y.	59.4	53.4	62.0	61.8	48.2	5.72	9.90
44	Pa.[b]	65.8	68.8	63.0	57.2	60.4	3.24	17.40
Average		62.5	59.2	64.2	59.8	48.6	---	---

[a]At 5% point

[b]Soil known to be infested with Pythium spp.

Table 51. Relative value of different protectants in improving emergence from cucumber seed

Treatment used	Number of times a given treatment (Column 1) was superior to					Total score[a]
	Yellow Cuprocide	Semesan	Arasan	Spergon	Untreated check	
Yellow Cuprocide	--	2	0	1	6	9
Semesan	0	--	1	1	5	7
Arasan	0	3	--	2	6	11
Spergon	0	1	0	--	5	6
None	0	0	0	0	--	0

[a]Maximum value 28

Table 49 gives the locations of the tests, dates of planting, soil types, environmental conditions, and average number of days required for emergence in the different trials.

The data on seedling emergence and their statistical significance are shown in Table 50. Table 51 shows the number of tests in which any given treatment was significantly superior to any one of the other treatments and furnishes a basis for determining the relative value of any of the treatments in this set of tests.

In 4 of the 7 trials (in Nos. 13, 20.1, 20.1a, and 24), all of the treatments gave significant increases in stand as compared with the untreated checks. In all trials, at least one of the treatments gave a significant increase. Arasan appeared to be the most effective treatment but the differences between it and Semesan and Yellow Cuprocide were not great; and Spergon, while somewhat less effective in the present tests, gave significant increases in stand in 5 of the 7 trials.

BUREAU OF PLANT INDUSTRY, SOILS, AND AGRICULTURAL ENGINEERING, AGRICULTURAL RESEARCH ADMINISTRATION, U. S. DEPARTMENT OF AGRICULTURE, BELTSVILLE, MD.

XIII. SWEETPOTATO SEED TREATMENTS

C. J. Nusbaum

Dip treatments have been recommended for sweetpotatoes primarily for protection against such seed-borne diseases as black rot (Ceratostomella fimbriata), scurf (Monilochaetes infuscans), and stem rot (Fusarium batatis and F. hyperoxysporum). These treatments also give some measure of control of such seedbed organisms as Pythium sp., Sclerotium rolfsii, and Rhizoctonia.

An 8 to 10 minute soak in 1-1000 mercuric chloride is generally recommended throughout the sweetpotato belt. Semesan Bel is also recommended and widely used in some areas. Although mercurial disinfectants have been satisfactory generally, in many cases delayed or reduced sprout production has been encountered as a result of their use. Therefore, increasing attention has been given to substitutes in the search for less critical materials which will give equal or better performance than mercury compounds. In recent tests by Dr. H. T. Cook and Dr. L. L. Harter, borax has shown promise as a sweetpotato seed treatment material, especially in the control of black rot. Interest has also been shown in Fermate. Spergon has been reported to be effective against stem rot in Kansas and New Jersey and against sclerotial blight in South Carolina but was disappointing in Virginia and Mississippi. In the introductory tests for 1943 it seemed advisable to limit the number of treatments to 4, with the intention of expanding the program to include other promising substitute materials, if the first year's results warranted continuance of the work on a cooperative basis. The treatments chosen for 1943 follow:

1. Fermate 1 lb. plus hydrated lime 1 lb. to 12-1/2 gal. water*
2. Mercuric chloride 1-1000**
3. Semesan Bel 1 lb. to 7-1/2 gal. water*
4. Borax 1 lb. to 6 gal. water***
5. Check, untreated.

* Instantaneous dip, bedded dry
** 8-minute soak, bedded wet
*** 10-minute soak, bedded wet.

Because of the difficulties involved in standardizing the procedures for a cooperative test involving diseased material, it was decided that, in the beginning at least, apparently healthy seed should be used. Attention was to be centered upon the effect of the treatments upon sprout production and the control of sprout and seedpiece decay.

In 1943, the test was conducted by only 2 cooperators. The Louisiana strain of the Porto Rico sweetpotato was designated for each test but this variety was not available in Virginia. Therefore the Maryland Golden variety was substituted. The results are shown in Tables 52, 53, and 54.

Table 52. Location, time, and environmental conditions under which sweetpotato seed treatment tests were conducted.

Report from Test no.	State	Planting date	Planted in	Soil type	Soil pH	Soil moisture	Temperature[a] 5 p.m.	Temperature[a] 8 a.m.	Rainfall	Days to emerge	Total duration
							°F	°F.	In.		days
47	S.C.	3/19	Bed[b]	Sandy loam	5.8	Dry	76.5	60.0	3.24[c]	31-39	67
51	Va.	3/30	Frame[d]	Sand	6.3	Dry	75.4	67.1	2.99[e]	49-50	84

[a] Average of daily soil temperature readings taken throughout total duration

[b] Manure-heated bed, covered with cloth March 19 to April 1, covered with glass April 1 to May 3, uncovered thereafter.

[c] Watered 11 times in addition to precipitation shown

[d] Coldframe, covered with sash until May 17, uncovered thereafter.

[e] Watered 3 times weekly until sash were removed.

Table 53. Effect of seed treatment on yield of sweetpotato sprouts.

Report from Test no.	State	Variety	Sprouts pulled from seed treated with[a] Fermate-lime	Mercuric chloride	Semesan Bel	Borax	Check (untr.)	Diff. req. sign.	Calc. "F" value
			A. Mean Number of Sprouts						
47	S.C.	Porto Rico	1013.0	747.7	742.7	983.2	764.0	161.2	6.16
51	Va.	Maryland Golden	410.5	300.5	342.5	390.5	326.0	NS	1.89
			B. Mean Weight of Sprouts in Grams						
47	S.C.	Porto Rico	4222.2	3041.8	3223.4	4040.6	3450.0	735.5	4.50
51	Va.	Maryland Golden	2567.5	1398.7	2005.0	1942.5	2127.5	437.5	8.71

[a] Sprouts pulled 3 times. Each treatment was replicated 4 times and each replicate consisted of 1/2 bu. (25 lbs.) of seed potatoes bedded in 1 sq. yd. of bed space. To obtain yield per bu. multiply by 2

SUMMARY. Although only 2 tests were conducted in 1943, the results indicate that both Fermate plus lime and borax treatments are promising as substitutes for the mercurials, especially if further investigation shows them to be effective against seed-borne diseases. With the Porto Rico variety both substitutes were significantly better than the check and the 2 mercury compounds in sprout production. The same trend was noted in the test with the Maryland Golden variety where the data did not meet the requirements for statistical significance, except with regard to weight of sprouts produced.

Table 54. Effect of seed treatments on sweetpotato bed diseases

Report from: Test no.	State	Variety	Incidence of disease from seed treated with: Fermate-lime	Mercuric chloride	Semesan Bel	Borax	Check (untr.)
A. Total Diseased Sprouts[a]							
47	S.C.	Porto Rico	0	0	0	0	16
51	Va.	Maryland Golden	4	2	9	9	7
B. Total Decayed Seed Roots[b]							
47	S.C.	Porto Rico	35	18	27	52	90
51	Va.	Maryland Golden	61	84	84	67	78

[a] 16 decayed sprouts in Porto Rico check showed Sclerotium rolfsii. Other cases undetermined.

[b] After last sprout pulling, "mother" seed roots dug up and examined. Cause of decay not determined.

In the case of the Maryland Golden variety there was practically no difference in the time of sprout emergence for any of the treatments. With Porto Rico, however, the mercury treatments exhibited marked delay. The average number of days from bedding to emergence for the Porto Rico variety was as follows: Fermate plus lime 31.7; borax 33.2; check, 33.2; Semesan Bel 37.0; and mercuric chloride 38.2.

With the Maryland Golden variety, seed treatment apparently had very little effect upon the incidence of sprout disease or decay of the seed roots. Aside from 2 small foci of Sclerotium rolfsii infection in the check plots, the Porto Rico sprouts appeared to be healthy. With this variety, however, all treatments reduced the incidence of root decay and the mercurials excelled in this respect. In both tests the incidence of seed root decay was quite high. However, the role it played in reducing sprout production was not determined.

SOUTH CAROLINA AGRICULTURAL EXPERIMENT STATION, EDISTO SUBSTATION, BLACKVILLE

XIV. CORN SEED TREATMENT TESTS FOR CENTRAL AND NORTHERN STATES REGION

George Semeniuk

In the winter of 1943 a corn seed-treatment subcommittee of the American Phytopathological Society was organised for the Central and Northern States Region. The purpose was to conduct a coordinated seed-treatment study within this region. The program followed was to determine the protection offered the corn seed and seedling from soil-borne pathogens by different fungicidal dusts. The identity of the soil-borne pathogens was investigated, and also the influence that various soil and climatic factors might have upon the incidence of disease.

Varieties used:

1. Illinois Hybrid 960 which in Iowa tests conducted by Dr. C. S. Reddy over a period of years has shown consistent benefits from seed treatment.
2. A compounded mixture of seeds of 10 commercially grown hybrids (obtained from a mid-western producer of hybrid corn) to obtain an "average" response to seed treatment.

Seed treatments:

1. Semesan Jr., 1-1/2 oz. per bu.
2. Barbak D (6% mercuric phenyl cyanamide), 1-1/2 oz. per bu.
3. Spergon, 1-1/2 oz. per bu.
4. Arasan (DuBay 1205-AL), 1 oz. per bu.
5. No treatment.

For uniformity, measured quantities of Illinois hybrid 960 and each of the 10 commercial hybrid seeds enough for all plantings at all stations were treated at one time and place. The treated seed was stored in tight containers for 24 hours before counting and packeting. Quantities of 100 seeds were counted out (which in the case of the mixed hybrids consisted of 10 kernels from each of the 10 hybrids treated alike), packeted and distributed to the various cooperators. Field plantings were made with 6 replications, 100 kernels to the 16-1/2 foot row, rows spaced 1 foot apart. The varieties with their split-plots of 5 treatments were alternated randomly. Plantings on different dates were made in adjacent areas.

The test locations and cooperators were as follows:

State	Location of test within State	Cooperator
1. South Dakota	Brookings	W. F. Buchholtz
2. Minnesota	St. Paul	H. B. Moore
3. Iowa	Ames	G. Semeniuk
4. Missouri	Columbia	C. M. Tucker
5. Wisconsin	Madison	P. E. Hoppe
6. Illinois	Urbana	B. Koehler
7. Indiana	Lafayette	A. J. Ullstrup
8. Ohio	Wooster	J. D. Wilson

Table 55. Soil and climatic conditions under which corn seed treatment tests were conducted.

State	Planting date	Soil condition: Type	Soil condition: pH	Soil condition: Moisture	Prevailing temperatures[a] Min.	Prevailing temperatures[a] Max.	Total rainfall[a]	Days to emerge
					°F.		in.	
S.D.	5/5				35.5	63.0[b]	0.34	
	5/24				51.5	74.6	1.20	
	6/3				49.3	69.8	3.34	
Minn.	4/28	Hempstead		21.8%	44.9	59.2[c]	2.59	21
	5/4	silt		24.2%	47.5	62.4	2.68	19
	5/11	loam		26.5%	48.8	61.1	2.96	16
	5/20			24.9%	56.4	68.5	2.78	12
Iowa	4/22	Webster		Opt., 28.4%	41.9	67.0[b]	2.20	12
	5/2	silty	5.2	Wet, 33%	44.0	64.9	3.24	14
	5/13	clay		Wet, 37%	47.1	64.5	1.98	11
	5/22	loam		Wet, 33%	49.8	73.1	0.79	8
	6/19			Opt.-	67.8	90.2	0.95	4
Mo.	4/28			Opt.				
	5/5			Wet				
	6/2			Wet				
	6/14			Opt.				
Wis.	4/28			Opt.	41.5	63.6[b]		
	5/14			Wet	43.9	65.4		
Ill.	4/21	Flanagan	5.4	Wet	56.7[b]		2.46	15
	5/3	silt		Wet	59.8		5.15	13
	5/22	loam		Wet	66.4		0.84	8
	6/5			Opt.	69.4		1.34	6
Ind.	4/22	Warsaw		Wet	50.0	66.6[c]	1.85	14
	5/4	silt		Wet	52.5	61.3	10.08	13
	5/14	loam	5.6	Wet	55.9	63.3	6.17	8
	5/26			Opt.	60.4	71.4	0.06	6
	6/5			Wet	60.8	71.1	1.48	6
Ohio	4/26			Opt.	48[c]			
	5/4			Opt.+	52			
	5/14			Wet	56			
	5/26			Opt.	68			
	6/4			Dry	73			

[a] For period from planting to emergence or for 10-day period following planting where days to emergence not given.

[b] Air temperature

[c] Soil temperatures at seed level

Table 56. Average emergence (= percentage) of corn in seed treatment tests.

State	Planting date	Illinois Hybrid 960						Mixed Hybrids					
		Seed treatment					Diff. for sign.[a]	Seed treatment					Diff. for sign.[a]
		Non-treated	Semesan Jr.	Barbak D	Spergon	Aramesan		Non-treated	Semesan Jr.	Barbak D	Spergon	Aramesan	
Minn.	4/28	68.7	84.0	82.5	82.7	92.5	4.97	71.5	83.0	80.7	79.3	84.7	6.13
	5/4	64.8	72.8	63.7	68.0	83.5	6.75	71.3	80.0	74.0	75.2	85.0	3.61
	5/11	66.5	77.5	69.8	75.3	82.8	3.92	71.8	85.0	82.2	82.3	83.2	5.21
	5/20	68.0	80.5	75.5	81.8	87.3	4.79	71.2	80.5	72.5	77.3	85.5	7.30
Iowa	4/22	80.5	94.0	89.5	92.8	94.5	3.85	88.7	90.0	89.2	93.7	88.3	2.24
	5/2	78.3	85.3	85.5	85.8	90.0	5.02	84.3	90.7	88.0	87.7	89.5	3.70
	5/13	76.8	92.8	82.2	91.0	93.7	2.28	82.3	88.7	86.5	89.2	89.0	4.36
	5/22	91.2	96.7	94.0	93.8	95.2	3.24	90.2	92.3	92.8	92.3	91.0	NS
	6/19	96.0	95.7	95.8	94.8	95.2	NS[b]	92.7	93.0	92.8	92.0	93.8	NS
Mo.	4/28	65.0	64.6	64.4	78.8	67.2	NS	65.3	65.7	67.0	74.8	66.2	NS
	5/5	44.5	45.7	44.7	58.8	46.3	8.21	45.5	48.7	47.5	55.0	42.5	7.39
	6/2	82.2	81.3	77.7	86.0	82.7	NS	78.2	80.7	83.3	81.5	81.7	NS
	6/14	81.0	79.3	79.5	83.3	75.3	NS	74.2	73.7	78.8	78.3	77.0	NS
Wis.	4/28	92.0	97.3	93.8	93.5	94.8	NS	84.3	89.7	88.7	89.5	91.7	3.43
	5/14	87.0	92.0	89.8	91.5	94.2	4.26	87.3	91.8	88.8	88.7	86.0	NS
Ill.	4/21	77.8	81.2	80.3	85.5	85.3	NS	69.7	75.0	75.3	78.3	82.2	2.32
	5/3	81.2	88.7	82.8	89.3	89.7	NS	84.5	89.7	89.0	88.5	86.3	NS
	5/22	87.2	84.7	87.5	85.8	85.7	NS	81.8	87.5	83.5	84.8	84.2	NS
	6/5	95.3	89.5	94.7	95.2	97.2	2.78	88.0	84.3	88.2	90.5	89.3	NS
Ind.	4/22	90.7	94.7	95.0	97.2	96.7	2.54						
	5/4	88.3	89.8	90.8	93.5	93.8	NS						
	5/14	90.7	90.0	87.5	93.5	93.2	3.80						
	5/26	91.8	94.8	91.7	94.0	92.5	NS						
	6/5	97.2	97.0	97.8	97.0	97.8	NS						
Ohio	4/26	69.8	87.0	85.3	93.3	93.3	2.39	79.3	85.0	85.0	88.0	88.5	NS
	5/4	89.3	89.3	91.8	88.2	84.7	2.28	88.3	89.0	87.8	86.2	87.8	NS
	5/14	89.2	90.7	89.8	86.3	84.7	4.00	85.7	90.8	85.2	86.0	85.2	NS
	5/24	84.3	86.0	85.7	86.7	82.2	NS	83.3	84.7	84.5	84.8	79.8	NS
	6/4	65.7	74.5	69.3	66.3	62.2	4.99	66.8	70.3	72.3	68.3	72.3	NS
S.D.[c]	5/5	89.7	91.7										
	5/24	95.0	95.7	"t" test nonsignificant									
	6/3	87.7	91.4										

[a] At the 5% level
[b] Nonsignificant
[c] 3 replications only

Table 57. Average percentage emergence of mixed hybrids and Illinois hybrid 960 analyzed as a complex test for corn seed treatment.

State	Planting date	Seed treatment					Diff.[a] for sign.
		Non-treated	Semesan Jr.	Barbak D	Spergon	Arasan	
Minn.	April 28	70.1	83.5	81.6	81.0	88.6	4.86
	May 4	68.0	76.4	68.8	71.6	84.3	3.74
	May 11	69.2	81.3	76.0	78.8	83.0	3.33
	May 20	69.6	80.5	74.0	79.6	86.4	3.93
	All dates	69.2	80.4	75.1	77.8	85.6	1.91
Iowa	April 22	84.6	92.0	89.3	93.2	91.4	2.36
	May 2	81.3	88.0	86.8	86.8	89.9	3.32
	May 13	79.6	90.8	84.3	90.1	91.3	3.30
	May 22	90.7	94.5	93.4	93.1	93.1	2.70
	June 19	94.3	94.3	94.3	93.4	94.5	NS
	All Dates	86.1	91.9	89.6	91.3	92.0	1.21
Mo.	April 28	65.2	65.2	65.7	76.8	66.7	4.49
	May 5	45.0	47.2	46.1	56.9	44.4	5.69
	June 2	80.0	81.0	80.5	83.8	82.2	NS
	June 14	77.6	76.5	79.2	80.8	76.2	NS
	All dates	67.0	68.0	68.0	74.4	67.5	2.63
Wis.	April 28	88.2	93.5	91.2	91.5	93.2	2.80
	May 14	87.4	91.9	89.3	90.1	90.1	NS
	All dates	87.8	92.7	90.3	90.8	91.7	2.03
Ill.	April 21	73.7	78.1	77.8	81.9	83.7	4.88
	May 3	82.8	89.2	85.9	88.9	88.0	4.17
	May 22	84.5	86.0	85.5	85.3	84.9	NS
	June 5	91.7	86.9	91.4	92.8	93.2	2.76
	All dates	83.2	85.1	85.2	87.2	87.5	1.89
Ohio	April 26	74.6	86.0	85.2	89.2	90.9	1.30
	May 4	88.8	89.2	89.8	87.2	86.2	1.39
	May 14	87.4	90.8	87.5	86.2	85.0	1.25
	May 24	83.8	85.4	85.1	85.8	81.0	2.65
	June 4	66.2	72.4	70.8	67.3	67.2	3.03
	All dates	80.3	84.7	83.8	83.8	82.1	6.94

[a] At the 5% level.

Table 58. Number of times each treatment is better than any other treatment. Significant and nonsignificant differences taken together.

State	No. of tests	Illinois hybrid 960					Mixed hybrids					Both groups combined					Max val ue
		Non tr.	Sem. Jr.	Bar bak D	Sper gon	Ara san	Non tr.	Sem. Jr.	Bar bak D	Sper gon	Ara san	Non tr.	Sem. Jr.	Bar bak D	Sper gon	Ara san	
Minn.	4	1	11	3	9	16	0	13	5	7	15	0	12	5	7	16	16
Iowa	4	0	11	6	8	15	1	12	9	12	7	0	13	6	8	11	16
Mo.	4	7	5	3	16	9	2	5	13	13	7	3	6	8	16	6	16
Wis.	2	0	7	3	3	7	1	7	4	4	4	0	8	2	4	5	8
Ill.	4	6	4	7	11	12	1	9	8	12	10	2	10	6	11	11	16
Ohio	1	0	2	1	3	3	0	1	1	3	4	0	2	1	3	4	4
Ind.	4	3	7	4	14	12											16
Totals	23	17	47	27	59	74	5	47	40	51	47	5	51	28	49	53	

[a] Number of tests showing general seed treatment benefit

Table 59. Number of times each treatment is significantly better than any other treatment.

State	Number of tests[a]	Seed treatment					Maximum value
		Nontreated	Semesan Jr.	Barbak D	Spergon	Arasan	
Illinois Hybrid 960							
Minn.	4	0	8	2	4	16	16
Iowa	4	0	7	3	4	8	16
Mo.	1	0	0	0	4	0	4
Wis.	1	0	1	0	1	2	4
Ohio	1	0	1	1	1	1	4
Ind.	1	0	1	1	2	1	4
Totals	12	0	18	7	16	28	48
Mixed Hybrids							
Minn.	4	0	7	3	3	9	16
Iowa	3	0	2	0	5	2	12
Mo.	1	0	0	0	4	0	4
Wis.	1	0	1	1	1	1	4
Ill.	1	0	1	1	3	4	4
Totals	10	0	11	5	16	16	40
Both Groups Combined							
Minn.	4	0	8	3	3	15	16
Iowa	4	0	9	4	6	4	16
Mo.	2	0	0	0	8	0	8
Wis.	1	0	1	1	1	1	4
Ill.	2	0	1	0	2	4	8
Ohio	1	0	1	1	3	4	4
Totals	14	0	20	9	23	28	56

[a] Tests showing significant seed treatment benefits

Table 60. Necrosis of mesocotyl and primary roots of maize in the seed treatment tests conducted in Iowa

Date of planting	Illinois Hybrid 960					Mixed Hybrids				
	Seed treatment				Diff.[a] for sign.	Seed treatment				Diff.[a] for sign.
	Non-treat.	Seman bak Jr.	Bar-gon D	Sper-san	Ara-san		Non-treat	Seman bak Jr.	Bar-gon D	Sper-san	Ara-san	
Percentage of Plants with Necrotic Mesocotyls												
April 22	16.5	13.5	12.3	14.7	17.6	NS[b]	39.8	26.1	18.7	26.4	24.6	6.29
May 2	27.7	19.3	22.0	21.3	19.4	NS	33.7	19.3	25.3	29.3	22.7	NS
May 13	54.0	37.7	43.7	47.3	46.3	10.30	50.3	41.0	48.7	49.7	41.3	NS
May 22	57.7	51.0	56.7	53.3	45.3	NS	64.0	50.0	58.7	54.3	56.7	8.09
June 19	75.3	49.3	38.3	67.7	64.0	8.46	80.7	61.0	86.0	67.3	66.3	8.95
Severity of Mesocotyl Necrosis[c]												
April 22	7.2	6.4	6.0	6.4	7.1	NS	21.3	14.4	8.2	13.8	13.1	4.67
May 2	13.3	8.3	9.2	9.0	8.0	NS	15.7	9.1	12.4	13.2	10.6	NS
May 13	26.4	17.7	21.6	21.7	22.4	NS	26.3	21.2	23.1	23.7	19.9	NS
May 22	26.9	23.6	27.9	24.4	22.4	NS	33.3	24.7	31.7	29.0	30.7	3.62
June 19	40.3	23.2	49.1	35.4	32.3	3.95	46.4	34.9	49.1	36.3	38.1	8.04
Percentage of Plants with Necrotic Primary Roots												
April 22	8.1	5.8	2.4	5.2	8.1	3.36	23.8	15.3	15.4	34.5	23.0	6.77
May 2	63.2	54.7	54.0	63.7	51.3	NS	70.7	65.9	69.8	68.6	64.3	NS
May 13	80.0	82.7	81.7	89.7	86.0	NS	92.3	90.7	88.3	95.7	92.3	NS
May 22	86.7	85.0	93.3	86.3	85.0	NS	93.7	89.0	91.7	90.7	94.7	NS
June 19	61.7	49.0	65.7	61.0	56.7	NS	82.0	77.7	77.7	76.0	78.0	NS
Severity of Primary Root Necrosis[c]												
April 22	3.3	1.9	0.9	1.7	3.1	NS	9.9	5.8	6.6	12.8	8.7	3.18
May 2	29.1	23.8	23.2	28.4	22.7	NS	33.4	30.7	35.0	35.3	29.6	NS
May 13	39.6	38.6	41.0	44.6	42.6	NS	56.6	50.4	51.1	54.5	57.2	NS
May 22	46.1	41.0	51.1	44.8	43.1	NS	58.4	52.3	51.4	53.3	57.1	NS
June 19	26.3	18.8	28.3	25.6	23.6	7.54	40.2	35.9	37.6	37.8	37.2	NS

[a] At the 5% level

[b] Nonsignificant

[c] Mesocotyls rated 0, 1, 2, or 3 according to whether they were zero necrotic, trace to 1/3 necrotic, 1/3 to 2/3 necrotic, or 2/3 to completely necrotic, respectively. Primary roots (radicle and seminals) were rated 0, 1, 2, or 3 according to whether there was no necrosis, one to several small necrotic areas on one or more roots, several medium elongated necrotic areas usually on 2 or more roots, much elongated necrotic areas up to complete or nearly complete necrosis of one (radicle)but usually all members of the primary root system, respectively.

Severity of disease determined as:

$$\frac{\text{Sum of ratings given individual plant parts}}{\text{Number of plants examined} \times 3} \times 100$$

Table 61. Necrosis of mesocotyl and primary roots of maize in the seed treatment tests conducted in Iowa. Analyzed on a complex test for treatment

Date of planting	Seed treatment: Nontreated	Semesan Jr.	Barbak D	Spergon	Arasan	Diff. for sign. 5% level
	Percentage of Plants with Necrotic Mesocotyls					
April 22	28.2	20.0	15.5	20.5	21.1	8.19
May 2	30.7	19.3	23.7	25.3	21.0	7.17
May 13	53.8	39.3	46.2	48.5	43.8	8.89
May 22	60.8	50.5	57.7	53.8	51.0	NS
June 19	78.0	55.2	87.2	87.5	65.2	6.46
All dates	50.3	36.8	46.0	43.2	40.4	3.29
	Severity of Mesocotyl Necrosis					
April 22	14.2	10.4	7.1	10.1	10.1	4.36
May 2	14.5	8.7	10.8	11.1	9.3	4.04
May 13	26.4	19.4	22.4	22.7	21.2	NS
May 22	26.4	24.2	29.8	26.7	26.5	NS
June 19	43.4	29.1	49.1	35.8	35.2	5.11
All dates	25.7	18.3	23.8	21.3	20.5	1.97
	Percentage of Plants with Necrotic Primary Roots					
April 22	16.0	10.5	8.9	19.8	15.5	6.14
May 2	66.9	60.2	61.9	66.1	57.8	NS
May 13	86.2	86.7	85.0	92.7	89.2	5.87
May 22	90.2	87.0	92.5	88.5	89.8	NS
June 19	71.8	63.3	71.7	68.5	67.3	NS
All dates	66.2	61.5	64.0	67.1	63.9	2.92
	Severity of Primary Root Necrosis					
April 22	6.6	3.9	3.8	7.2	5.9	2.52
May 2	31.3	27.2	29.1	31.9	26.2	NS
May 13	48.1	44.6	46.1	49.5	49.9	NS
May 22	52.3	46.7	51.3	49.0	50.3	NS
June 19	33.3	27.3	33.0	31.7	30.4	NS
All dates	34.3	29.9	32.6	33.9	32.5	2.11

Table 62. Mean percentage of plants exhibiting primary root necrosis. Seed treatment tests conducted in Ohio.

Date of planting	Date of examination	Illinois Hybrid 960 — Seed treatment: Non-treated	Semesan Jr.	Barbak D	Spergon	Arasan	Mixed Hybrids — Seed treatment: Non-treated	Semesan Jr.	Barbak D	Spergon	Arasan
April 26	June 19	15.0	1.7	11.7	10.0	8.3	10.0	8.3	8.3	8.3	3.3
May 4	June 19	13.3	3.3	5.0	5.0	5.0	13.3	5.0	6.7	6.7	6.7
May 14	June 28	20.0	5.0	13.3	18.3	8.3	16.7	5.0	10.0	5.0	6.7
May 24	July 7	13.3	6.7	5.0	6.7	8.3	15.0	10.0	5.0	6.7	10.0
June 4	July 7	10.0	10.0	3.3	0.0	1.7	8.3	3.3	5.0	1.7	1.7
Mean of all dates		14.3	5.3	7.7	8.0	6.3	12.7	6.3	7.0	5.7	5.7

Table 63. Mean total green weight (lbs.) of plants per plot in corn seed treatment tests conducted in Missouri

Date of planting	Seed treatment: Nontreated	Semesan Jr.	Barbak D	Spergon	Arasan	Diff. for signif.-5%
April 28	8.0	8.4	8.3	10.8	10.5	1.85
May 5	7.2	6.4	7.7	9.6	6.9	1.43
June 2	5.8	6.1	5.9	6.2	6.1	NS
All dates	6.9	6.9	7.2	8.8	7.7	0.76

Table 64. Mean green weight (lbs.) per individual plant in the corn seed treatment tests conducted in Missouri.

Date of planting	Seed treatment: Nontreated	Semesan Jr.	Barbak D	Spergon	Arasan	Diff. for signif.-5%
April 28	.244	.248	.231	.282	.305	.020
May 5	.352	.323	.381	.361	.350	NS
June 2	.144	.150	.145	.148	.149	NS

Table 65. Mean total green weight (grams) of plants in corn seed treatment tests conducted in Ohio. Analyzed as random blocks.

Date of planting	Seed treatment: nontreated	Semesan Jr.	BarbakD	Spergon	Arasan	Diff. for signif.-5%
Illinois Hybrid 960						
April 26	1983	1959	2169	2260	2465	266.0
May 4	1620	1674	1810	1821	1718	---
May 14	2191	2291	2264	2149	2172	---
May 24	2465	2489	2314	2429	2386	---
June 4	889	1098	883	880	872	97.4
Mixed Hybrids						
April 26	1724	1794	1935	1867	1842	---
May 4	1692	1489	1676	1565	1549	---
May 14	2022	2114	1993	2096	1942	---
May 24	2376	2550	2438	2523	2437	123.0
June 4	797	784	885	845	870	---

Table 66. Mean number of strong plants in corn seed treatment tests conducted in Illinois. Analyzed as random blocks.

Date of planting	Seed treatment: ontreated	Semesan Jr.	Barbak D	Spergon	Arasan	Diff. for signif.-5%
Illinois Hybrid 960						
April 21	66.3	72.3	69.8	80.0	76.3	9.30
May 3	74.3	81.7	75.0	83.0	85.2	6.42
May 22	79.3	75.0	80.3	77.2	77.3	---
June 5	88.0	85.3	90.2	89.9	92.2	4.03
Mixed Hybrids						
April 21	57.2	62.3	63.5	68.5	75.5	6.14
May 3	78.3	83.7	81.8	82.3	78.3	---
May 22	71.2	78.5	74.8	71.3	76.2	---
June 5	80.5	78.2	83.8	84.5	80.8	---

Table 67. Mean percentage of weak plants calculated on the basis of emerged seedlings in corn seed treatment tests conducted in Illinois.

Date of planting	Seed treatment					Diff. for signif.-5%
	Nontreated	Semesan Jr.	Barbak D	Spergon	Arasan	
Illinois Hybrid 960						
April 21	15.1	11.6	13.3	10.7	8.3	4.40
May 3	8.4	8.0	9.5	5.3	7.1	---
May 22	9.0	11.5	8.3	9.8	10.2	---
June 5	7.8	6.5	4.8	6.5	5.6	---
Mixed Hybrids						
April 21	18.1	17.0	15.6	8.1	12.9	5.62
May 3	7.3	6.7	8.0	9.4	7.0	---
May 22	13.1	10.3	10.4	9.6	14.8	---
June 5	8.6	7.3	6.6	9.6	6.6	---

Summary and Discussion of Results

Some of the soil and climatic conditions surrounding each test at each of the stations are shown in Table 55, while the results of the tests are presented in the accompanying Tables. Cold wet soil conditions prevailed throughout much of the normal corn-planting period in this region except in South Dakota where the conditions were cold and dry until the latter part of May and the first of June. Significant benefits in emergence from seed treatment (Tables 56 and 57) were obtained at all April and May plantings made in Minnesota and Iowa, in 2 plantings made in Wisconsin, in 2 late April-early May plantings made in Illinois and Indiana, and in the late April planting made in Ohio. Prevailing low soil temperatures of approximately 55°F. maximum during the spring period with accompanying wet conditions appeared coincidental with significant benefits in emergence from seed treatment. Figures 1 and 2 show the general relationship of the time taken for the corn to emerge and (1) the prevailing temperatures, and (2) the percentage of emergence, respectively.

A comparison of the relative efficiency of the different fungicides in increasing emergence points to a varying effectiveness of the fungicides with the different locations and to a minor extent with the 2 varieties (Tables 58 and 59). Barbak D generally proved inferior to one or more of the other 3 fungicides at all locations at the different planting dates, more so on Illinois hybrid 960 than on the mixed hybrids, despite the benefits in emergence resulting from its use. In Minnesota, of the 4 fungicides Arasan proved significantly better than any of the other seed treatment dusts, with Semesan Jr. being next in effectiveness, followed by Spergon. In Missouri, Spergon proved significantly superior to the other 3 fungicides. In Iowa, Arasan, Spergon, and Semesan Jr. benefited emergence to a similar extent with a slight advantage going to Arasan in the case of Illinois hybrid 960, and equally to Spergon and Semesan Jr. in the case of the mixed hybrids. In Wisconsin, Semesan Jr. and Arasan appeared a little more effective on both hybrids than either Spergon or Barbak D. In Illinois, Indiana, and Ohio (April 26 planting) Spergon and Arasan seed treatment proved to be of the greater benefit to emergence.

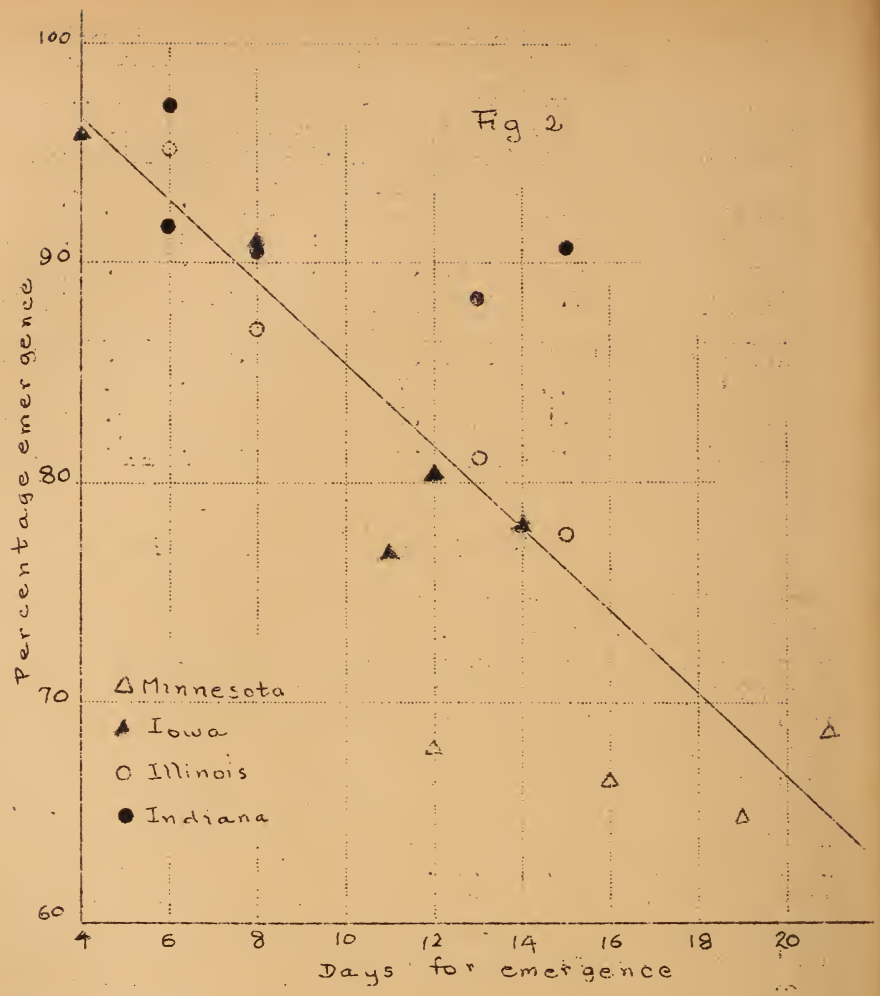

Figure 2. Regression of percentage emergence of Illinois hybrid 960 over 4 locations on the days required for emergence

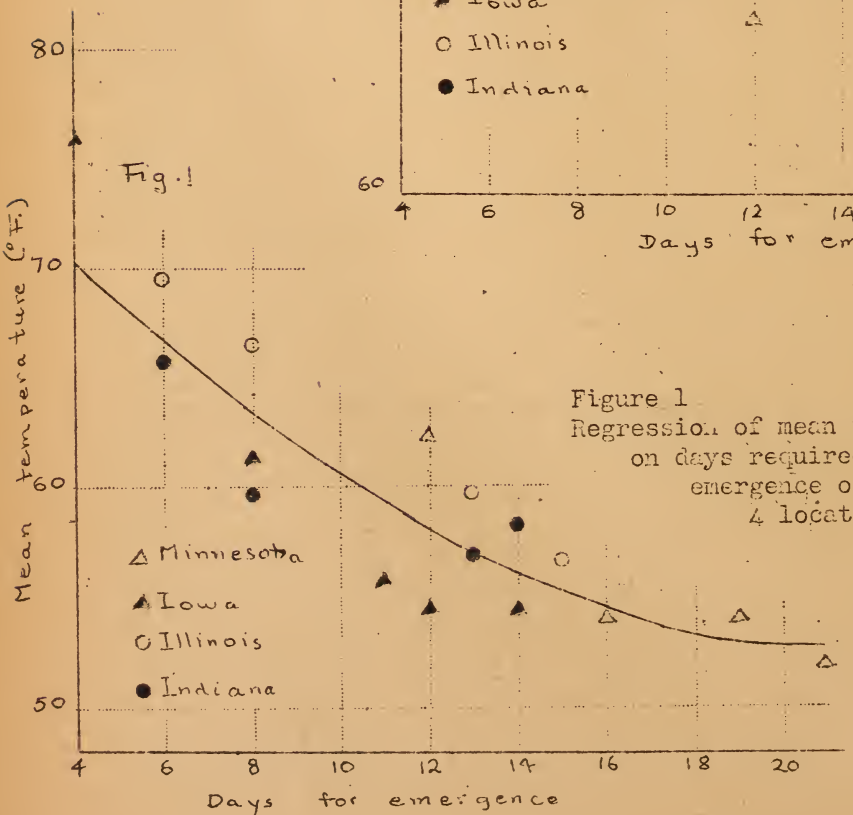

Figure 1
Regression of mean temperature on days required for the emergence of corn over 4 locations.

The apparent injury from Arasan in the Ohio May-June plantings remains unexplained.

The incidence of mesocotyl and primary root necrosis on seedlings developed from treated and non-treated seed planted at different dates was determined in the Iowa tests. The plants were dug when approximately 2 to 2-1/2 feet high, washed, and the extent of mesocotyl and primary root necrosis rated independently for each of 50 plants per treatment row, in all 300 treatment rows for the 5 dates of planting. The plants from the first 4 planting dates were examined in mid-June, when they were rapidly approaching about the same stage in development. The weather throughout May was predominantly cold, wet, and cloudy, followed by warmer, sunshiny, but still wet weather the last few days in May and the first half of June. The plants examined on July 14 for the last planting made June 19 had developed under warmer temperatures but less than optimum soil moisture conditions. The incidence of disease on seedlings was progressively greater with each successively later date of planting made (Tables 60 and 61) despite the longer growing period to which plants of the earlier planting were subjected. Greater incidence of disease occurred on the mixed hybrids than on Illinois hybrid 960. Benefits from seed treatment in the reduction of mesocotyl necrosis were noted at all planting dates, though not all of these benefits were significant. Benefits to primary root necrosis were less frequent, occurring for the most part in the 2 earliest plantings. Semesan Jr. proved superior to the other 3 fungicides in reducing mesocotyl necrosis while Spergon and Arasan were next in effectiveness and Barbak-D was generally the least effective. Reductions in primary root necrosis appeared significant with Semesan Jr. in several instances. Similar data on root necrosis for the Ohio tests (Table 62) revealed distinct benefits from seed treatment but without any consistent advantage of one or more treatments over the others. No differences in mesocotyl necrosis between Semesan Jr.-treated and non-treated seed were noted in South Dakota.

Total seedling green weight determinations per treatment row in Missouri (Table 63) and Ohio (Table 65) revealed some significantly greater green weights due to seed treatment with Spergon, Arasan, and Semesan Jr. at several dates of planting. On the weight per plant basis in Missouri, significant increases in weight were obtained only with Arasan on Illinois hybrid 960 in the planting of April 28 (Table 64).

At several planting dates in Illinois seed treatment produced significantly higher percentages of strong plants (Table 66), the percentages being based on the number of planted seeds. Levels of significance were reached in only the first planting with Spergon and Arasan when such percentages were computed on the basis of emerged seedlings (Table 67).

Isolations from necrotic primary roots in Ohio revealed a species of Gibberella affecting many of these roots. In South Dakota isolations made from 8 infected mesocotyls on July 5 from plants in the June 3 planting yielded Fusarium from 5 mesocotyls, Pythium sp., P. debaryanum, and no organism from the remaining 3 mesocotyls. The Iowa isolations from necrotic mesocotyls from the first, third-fourth, and fifth dates of planting (Table 68) yielded predominantly Fusarium moniliforme alone or

Table 68. Summary of Iowa isolations of fungi from necrotic corn mesocotyls

Date of planting	Number of mesocotyls examined	Number of mesocotyls yielding: Fusarium moniliforme	F. moniliforme + Trichoderma	F. moniliforme + chlamydospore fungus	F. moniliforme + chlamydospore fungus + Trichoderma	Trichoderma	Mucor
April 22	5	2	1	0	0	2	0
May 13-22	7	1	2	1	2	0	1
June 19	10	5	2	2	0	1	0

Table 69. Summary of fungi isolated from necrotic primary roots of corn in the Iowa test.

Date of planting	Number examined: Plants	Roots	Number of roots yielding: Helminthosporium	Fusarium moniliforme	Chlamydospore fungus	Rhizoctonia	Pythium	Diplodia zeae	Penicillium	Mucor	Trichoderma
April 22	12	17	13	9	3	2	3	1	0	0	0
May 13-22	15	40	33	27	40	0	1	0	0	0	2
June 19	13	20	14	15	6	0	0	0	2	1	3

Table 70. Frequency of association of fungi isolated from the same primary root portions in the Iowa tests.

Date of planting	Number examined: Plants	Roots	Helminthosporium	Fusarium moniliforme	Chlamydospore fungus	Helminthosporium + Fusarium	Helminthosporium + Chlamydospore fungus	Fusarium + Chlamydospore fungus	Helminthosporium + Fusarium + Chlamydospore fungus
April 22	12	17	1	2	0	4	1	0	2
May 13-22	15	40	1	0	3	7	6	6	19
June 19	13	20	4	5	0	4	2	0	2

together with Trichoderma, and/or an unidentified chlamydospore-producing organism found abundantly on the roots. A few mesocotyl tissues yielded only Trichoderma or Mucor sp., while one mesocotyl yielded Gibberella sp. Necrotic primary roots from the first and last dates-of-planting plots yielded predominantly Helminthosporium sp. and Fusarium moniliforme, while those from the third-fourth dates-of-planting plots yielded to the greatest extent an unidentified chlamydospore-producing organism, followed by Helminthosporium sp. and Fusarium moniliforme (Table 69). All 3 fungi were found most frequently in association with one another, with Helminthosporium sp. dominating the association (Table 70). The chlamydospore-producing organism was much more abundant on plants from corn planted on the third-fourth dates than on either the first or last dates. Pythium and Rhizoctonia were isolated mainly from the earlier planted corn. Diplodia zeae was isolated from the primary root of one plant in the early-planted corn.

IOWA AGRICULTURAL EXPERIMENT STATION, AMES

XV. 1943 RESULTS OF UNIFORM SEED TREATMENT TESTS ON SOYBEANS

Benjamin Koehler

The uniform seed treatment test on oil type soybeans was conducted in 9 North Central States in 1943. These tests were directed by the War Emergency Committee of the Upper Mississippi Valley Plant Pathologists. All the seed was treated and sent out to the cooperators from the U. S. Regional Soybean Laboratory at Urbana, Illinois. Seed of low viability was used and the planting rate was about 1 bushel of seed per acre. In the northern section (South Dakota, Minnesota, and Wisconsin) a Manchu-type soybean (72% germination) was used while in the rest of the area the Lincoln variety (47% germination) was used.

In order to study the effect of seed treatment on the effectiveness of inoculation with nodule bacteria, the plots were split, each whole plot consisting of 2 18-foot rows with the same chemical treatment, 1 row inoculated just before planting and 1 row left uninoculated. Each cooperator was furnished with a humus culture of soybean nodule bacteria with instructions to insure uniform inoculation at the different locations. Four randomized blocks were planted at each location. Since the treatment by inoculation interaction this year was not significant the estimates of stand and yield given in the Tables are the average of 8 replications.

Data were taken on both stand and yield. The seed treatment chemicals and rates of application per bushel were as follows: Untreated check, Semesan Jr. 2 oz., Fermate 1 oz., New Improved Ceresan 1/2 oz., Arasan 1 oz., Arasan 2 oz., Spergon 2 oz., and Spergon 3 oz.

Table 71 gives the names of the cooperators, locations, and general effects of the seed treatments at the various locations.

Table 71. Cooperators, locations, and general results of soybean seed treatments, 1943

Location	Cooperator's Name	Planting date	Significant effect of chemical treatment on stand	on yield
Brookings, S.D.	W.F.Buchholtz	June 18	None	Increase
Lincoln, Nebr.	J.E.Livingston	May 28	Increase	None
Manhattan, Kans.	J.W.Zahnley E.D.Hansing	May 29	None	None
Columbia, Mo.	C.H.Tucker	June 28	None	None
Ames, Iowa	G.C.Kent	May 28	Increase	Decrease
St. Paul, Minn.	I.W.Tervet	June 5	Increase	(a)
Urbana, Ill.	W.B.Allington	May 31	Increase	None
Madison, Wis.	J.G.Dickson	May 27	None	(a)
Columbus, Ohio	L.C.Saboe	June4	Increase	None

(a) Not harvested

Effect of Soybean Seed Treatment on Stands

Significant increases in stand from seed treatment were obtained in Minnesota, Ohio, Illinois, Iowa, and Nebraska, whereas the increases were not statistically significant in Wisconsin, South Dakota, Kansas, and Missouri. For all the stations together every treatment used was significantly better than the check as shown in Tables 72 and 73. The heavy

Table 72. Effect of various chemical seed treatments on the stand of Lincoln soybeans at 6 central locations in 1943

Treatment Chemical	Oz/ Bu	Average number plants per row[a]						
		Urbana Illinois	Columbus Ohio	Columbia Missouri	Ames Iowa	Lincoln Nebraska	Manhattan Kansas	Mean
Check		69	56	76	88	83	99	79
Semesan Jr.	2	89**	66*	75	95*	89	103	86**
Fermate	1	86**	73**	83	99**	93*	107	90**
New Improved Ceresan	1/2	85**	74**	78	93	100**	103	89**
Arasan	1	88**	73**	78	91	93*	106	88**
Arasan	2	93**	80**	83	101**	96**	107	93**
Spergon	2	82**	66*	83	92	90	106	87**
Spergon	3	90**	74**	84	90	89	105	89**
MSD (1%)		8	12	--	10	12	---	6
(5%)		6	9		7	9		4

[a]181 seeds planted per 18 ft. row
*Significant over the check
**Highly significant over the check

Table 73. Effect of various seed treatments on the stand of Manchu soybeans at 3 northern locations in 1943.

Treatment Chemical	Oz/ Bu	Average number plants per row[a]			
		Madison Wisconsin	St.Paul Minnesota	Brookings South Dakota	General mean
Check		75	38	40	51
Semesan Jr.	2	81	42	49	57*
Fermate	1	87	39	49	58*
New Improved Ceresan	1/2	82	40	53	58*
Arasan	1	85	42	51	59**
Arasan	2	80	44	54	59**
Spergon	2	83	45	53	60**
Spergon	3	84	56**	55	65**
MSD (1%)		--	14	--	8
MSD (5%)		--	10	--	6

[a]118 seeds planted per 18-ft. row
*Significant over the check
**Highly significant over the check

application of Arasan appeared to be the best treatment this year. The treatment x station and the inoculation x treatment interactions were not statistically significant. Very little is known concerning the causal factors for seed decay, seedling diseases, etc., with soybeans, consequently nothing was learned in regard to control of specific diseases of that nature. Most of the plantings were made later than the normal time due to unfavorable weather conditions. Fairly accurate records were kept of the environmental conditions from the time of planting until the final stand counts were taken. The effectiveness of the seed treatments apparently did not depend upon any one environmental factor.

Effect of Soybean Seed Treatment on the Yield

Somewhat better yields were obtained from treated seed than from untreated seed in South Dakota, Kansas, Illinois, and Ohio, but only in South Dakota were the increases significant as shown in Table 74. No increases were obtained in Missouri, Iowa, and Nebraska. Yields were not obtained at St. Paul, Minnesota, and at Madison, Wisconsin.

Table 74. The effect of seed treatment on the yield of Lincoln soybeans at 6 locations and Manchu soybeans at 1 location in 1943

Treatment	Oz/Bu	Yield (grams per 16 ft. row)[a]							
		Brookings S.D.	Urbana Ill.	Columbus Ohio	Columbia Mo.	Ames Iowa	Lincoln Nebr.	Manhattan Kans.	Mean of 6 locations[b]
Check		221	730	780	430	1244	902	708	799
Semesan Jr.	2	271	730	872	394	1205	848	755	801
Fermate	1	297*	733	843	412	1169	888	769	802
New Improved Ceresan	1/2	315*	760	842	404	1177	834	712	788
Arasan	1	304*	779	858	427	1140	908	777	815
Arasan	2	315*	775	850	434	1220	903	758	823
Spergon	2	313*	768	898	428	1053	878	737	794
Spergon	3	337**	773	855	390	1231	836	773	810
MSD (1%)		98							
(5%)		72							

*Significant over the check
**Highly significant over the check
[a]Manchu variety at Brookings, S.D., Lincoln variety at other locations
[b]Data from Brookings excluded

Although in many cases attempts were made to locate the plots where soybeans had never been grown before in order to test adequately the effect of seed treatment upon the effectiveness of inoculation, only one station met with apparent success. At Brookings, South Dakota, the uninoculated rows were entirely free of nodules, while nodulation occurred in the inoculated rows. Careful examination of roots at this station disclosed

that all the seed treatments were detrimental but not prohibitive to nodulation. The most interesting result in regard to inoculation, however, is that with the exception of Urbana, Illinois, all the locations reported decreased yields with inoculation. This was true of the checks as well as of the chemical treatments. The reason for this unexpected result is obscure. No effect on stands was found but some of the yields were reduced significantly and the general reduction in yield at all locations was highly significant (Table 75).

Table 75. Effect of inoculation in uniform seed treatment experiment on yield of soybeans in 1943.

Location	Mean yield[a] Inoculated	Uninoculated	MSD
Urbana, Illinois	768	743	
Columbus, Ohio	845	855	
Columbia, Missouri	393	435**	33
Ames, Iowa	1158	1201	
Lincoln, Nebraska	866	882	
Manhattan, Kansas	736	760*	19
Brookings, South Dakota	287	305	
Mean	794	813**	16

*Significant over the check
**Highly significant over the check
[a]Grams per 16 ft. row

At the locations where the plants from uninoculated seed were well nodulated, treatments with the seed disinfectants used had no noticeable retarding effect on nodulation.

The common farm practice at present is to plant more soybean seed per acre than is absolutely necessary in order to have added assurance of good stands. The result from seed treatment tests this year indicate that the rate of seeding might possibly be reduced about 10 percent without a reduction in stand if the seed is treated.

These tests must be conducted for several more years before definite conclusions can be reached. At present seed treatment for soybeans cannot be recommended.

(Soybean Seed Treatment Committee

W. B. Allington, U.S. Regional Soybean Laboratory
G. C. Kent, Iowa Agricultural Experiment Station
I. W. Tervet, Minnesota Agricultural Experiment Station
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XVI. THE PRE-TREATMENT OF SEED BEFORE DISTRIBUTION TO GROWERS

George L. McNew

Should vegetable and other seed be treated by the seedsmen before it is distributed to the growers? If so, what seed should be treated, what problems will this present to the seedsmen and what can plant pathologists do to assist the seedsmen in overcoming these difficulties?

A. Introduction

During the past 25 years considerable information has been secured on the value of seed treatments. Most competent authorities now agree that treatment is quite essential to the production of certain crops, in some cases to prevent transmission of disease agents, in others to protect the seed from soil-inhabiting disease organisms.

There are very few agricultural practices that pay such large dividends for such a modest investment as that required for seed treatment. The cost of treatment for an acre of sweet corn is only 3 cents; lima beans, 10 cents; spinach, 25 cents; and peas, 67 cents. Such treatments are wise investments because they serve as insurance against stand failure that may cost as much as $20 an acre in refitting and reseeding, to say nothing of reseeding at a less favorable planting date. Yield increases in many areas may give returns of $2 to $40 an acre. There are a few localities in the United States where authorities have not yet fully determined whether seed treatment is essential; but, forthe most part, the practice is being urged throughout the country. The need for seed treatment is so universally recognized that it does not enter into this discussion.

The question immediately confronting plant pathologists is how to secure the most effective use of seed treatments. For over 20 years plant pathologists have been busy educating grower groups. In many areas they have made excellent progress particularly with large commercial growers and well-organized groups such as canners. For the most part, however, the accomplishment with small growers has been unsatisfactory. The failure has come from 4 sources:

(1) The difficulty of treating small lots of seed properly in the home (many growers still use the wrong dosage, improper chemical, and secure inadequate coverage).
(2) Confusion arising from the necessity of recommending different chemicals for different crops (the layman is slow to grasp such basic facts as the toxicity of copper to cabbage seed when the same material is ideal for spinach.
(3) The inherent negligence and carelessness of human beings in disposing of small details, and
(4) Failure of fungicide manufacturers to make materials easily accessible to all communities.

Probably nothing is more discouraging to the plant disease specialists than the difficulty the growers encounter in obtaining the necessary

chemicals. In many areas, today, plant pathologists are shaping their recommendations according to the chemicals available in rural communities rather than according to their fungicidal value. The fungicide distributors are confronted with a very difficult and expensive problem in adequately supplying the "small-package" trade. In spite of the high prices charged, it is not the most satisfactory solution to retailing. In times of national emergency such as this there is a question whether such inefficient distribution can survive. It is doubtful whether the nation can afford to provide the necessary small containers, extra labor for packaging and distributing, and large inventories of chemicals required to stock the shelves in every community.

In spite of the progress made with grower groups, it may be well to seek a more direct approach to the problem of treating seed. At the suggestion of Dr. I. E. Melhus, Chairman of the Upper Mississippi Valley group of the War Emergency Council, studies were begun in 1942 as a part of the vegetable seed treatment program for the American Phytopathological Society. Dr. R. H. Porter of Iowa and Dr. W. D. Crosier of New York established contact with the seed trade and with official seed analysts, and the writer approached the plant pathologists throughout the United States. These activities were incorporated into the program of the War Emergency Council's sub-committee on fungicides under the chairmanship of Dr. J. G. Horsfall during 1943. It is the purpose of this report to review the facts obtained to date on the possibilities of encouraging seedsmen to pre-treat vegetable seed before it is distributed.

B. Problems Involved in Inaugurating a Program of Pre-Treating Seed

There are many obvious advantages in having the seed treated at the warehouse before it is distributed to the growers. Some of these are as follows:

1. Assures more general use of seed treatments.
2. Assures proper use of chemicals and will avoid waste by carelessness, excessive dosages, and misuse. It will be much easier for us to advise a relatively few alert, well-organized seedsmen than to control the activities of every gardener and farmer. Furthermore, it is possible to use the exact minimum concentrations on large, bulk treatments in a fashion never to be obtained on small packets by the grower.
3. Promotes economy and efficiency in distributing fungicides.
   a. Manufacturers of fungicides can sell wholesale directly to a few customers.
   b. Eliminate salesmen and retailers and thereby release labor for other war efforts.
   c. Eliminate inventories of chemicals on retailers' shelves and thereby release a large supply for immediate use. This benefit alone would do as much to increase the available supplies of chemicals as any other change we could suggest in use of chemicals.

d. Eliminate much of the demand for small containers to hold quarter-pound to five-pound lots of chemicals. Containers are critically scarce and could be released for other uses.
e. Eliminates the labor and machinery used in packaging small samples of chemicals.
f. Would promote efficient distribution of chemicals direct from central warehouses to the people who use them. This would keep available supplies mobile so they could be shifted to the locality where needed, and would permit greater control and planning over manufacture and use of fungicides.

4. Eliminates the possibility of buying a pound of chemical to treat a few ounces of seed. The excess is either discarded or often left around the house or barn where it is a hazard to children and livestock

There are also many disadvantages to be overcome if such a program is to be inaugurated at present. Some of the arguments frequently advanced against such a program have been as follows:

1. Supplies of seed-treatment chemicals are inadequate. (Partially true but could be overcome by more efficient methods).
2. It would be difficult to secure the necessary additional labor for treating the seed. (A sound argument).
3. Impossible to provide necessary new equipment. (Could be improvised).
4. Unsold stocks at end of year could not be used for food, or as livestock feed. (True)
5. Treated seed lose vitality upon storage more rapidly than untreated seed. (A misconception so far as most safe fungicides are concerned.
6. Seed treatments deteriorate upon storage of seed, therefore they could not be applied well in advance of the planting season. (This applies to very few fungicides).
7. There are no treatments universally adapted to all climates and all soil types.
8. The scientific experts cannot agree on a uniform set of recommendations; therefore the seed dealer cannot be assured of their support if he treats his seed.
9. The public does not demand treated seed; therefore there is no sales advantage to the companies who go to the expense of treating.
10. In some localities, there will be active sales resistance to purchase of packages marked with "poison" signs and a warning about use of treated seed. (Probably an authentic argument but can be overcome by education)
11. The average gardener regularly plants an excessive number of seeds and thins to stand, therefore no particular damage is done by a 15 to 60% stand loss. (The obvious answer to this is that he overplants because he has come to expect stand failures a fair percentage of the time. Accurate seeding rates can never be recommended until the extreme losses during unfavorable weather periods are prevented by treatment)
12. Treated seed cannot be distributed through the mails.

13. The seed treatments are poisonous and present a health hazard to workers in seedhouses and to growers. (True, but new materials that are fairly safe can be used on many crops).

These and similar arguments must be answered completely if we are to secure the support of the seedsmen in this program. Most of the technical arguments arise from misconceptions and inadequate information as to the nature and value of treatments. These can be answered quite easily.

Other arguments such as those in 8, 9, and 10 are not fully authentic but contain enough truth to emphasize the plant pathologists' failure in presenting their case to the public.

The seedsmen have a right to demand that the plant pathologists define their position more clearly before making any nation-wide recommendations for seed treatment. In order to do this, a careful survey was made of the plant pathologists throughout the United States to determine (1) their attitude regarding the need of pre-treatment, (2) the extent to which they would endorse a uniform set of recommendations, and (3) the recommendations (as of May 1943) in vogue in different States. These reports are summarized briefly in the following 3 sections.

C. To What Extent Will the Plant Disease Specialists Support Seedsmen Who Pre-Treat Seed?

In order to determine whether the people who make recommendations to the growers throughout the United States would support a program of treating seed a questionnaire was sent to interested research and extension authorities in each State. The following questions were asked of these specialists:

A. Do you believe pre-treatment of vegetable seed desirable?
B. Do you believe pre-treatment of cereal seed desirable?
C. Do you believe pre-treatment of corn seed desirable?
D. Do you believe pre-treatment of cotton seed desirable?
E. Do you believe pre-treatment of flax seed desirable?
F. Will you support a program of pre-treating vegetable seed to the extent of giving it effective publicity in your State, by providing press releases for newspapers, delivering radio talks, discussions before garden clubs and other groups, or by special means such as bulletins and extension news?
G. Would you be willing to educate the victory gardeners of your State as to the benefits from buying treated seed by working directly with their councils?

Answers were received from the following 47 specialists throughout the United States:

1.	Arizona	J. G. Brown
2.	Arkansas	V. H. Young
3.	California	L. D. Leach
4.	California	W. C. Snyder
55.	Connecticut	J. G. Horsfall
6.	Florida	W. B. Tisdale
7.	Illinois	M. B. Linn
8.	Indiana	R. W. Samson
9.	Indiana	Charles Gregory
10.	Iowa	R. H. Porter and I. E. Melhus
11.	Kansas	Botany Dept. (L. E. Melchers)
12.	Kentucky	W. D. Valleau
13.	Maine	Donald Folsom
14.	Maryland	C. E. Cox
15.	Massachusetts	O. C. Boyd
16.	Massachusetts	E. F. Guba
17.	Minnesota	C. J. Eide
18.	Mississippi	J. A. Pinckard
19.	Missouri	C. M. Tucker
20.	Montana	H. E. Morris
21.	New Hampshire	M. C. Richards
22.	New Jersey	C. M. Haenseler
23.	New York	Charles Chupp
24.	New York	George L. McNew
25.	New York	Willard Crosier
26.	North Carolina	H. R. Garriss and D. E. Ellis
27.	North Dakota	W. E. Brentzel and F. G. Butcher
28.	Ohio	C. C. Allison
29.	Ohio	J. D. Wilson
30.	Oklahoma	K. S. Chester and J. H. McLaughlin
31.	Oregon	F. P. McWhorter
32.	Pennsylvania	R. S. Kirby
33.	Rhode Island	F. L. Howard
34.	Tennessee	C. D. Sherbakoff
35.	South Carolina	W. C. Nettles
36.	South Carolina	C. J. Nusbaum
37.	South Carolina	C. N. Clayton
38.	South Dakota	W. F. Buchholtz
39.	Vermont	C. H. Blasburg
40.	Virginia	R. P. Porter
41.	Virginia	E. K. Vaughan
42.	Washington	C. J. Gould
43.	West Virginia	J. G. Leach
44.	Wisconsin	J. C. Walker and R. E. Vaughan
45.	U. S. Dept. Agr. (Extension Service)	R. J. Haskell
46.	U. S. Dept. Agr. (Bureau of Plant Industry Station, Maryland)	S. P. Doolittle
47.	U. S. Dept. Agr. (at Georgia Coastal Plain Experiment Station)	W. D. Moore

The answers of these men are summarized in Table 76:

Table 76. Opinion of plant pathologists in different States regarding pre-treatment of different seeds.

Report from:	Opinion regarding different questions						
	Is pre-treatment desirable?					Amount of publicity[a]	Inform victory gardeners
Question	Vegetable (A)	Cereal (B)	Corn (C)	Cotton (D)	Flax (E)	(F)	(G)
1. Ariz.	Yes	Some	No	No	--	P R T A	Yes
2. Ark.	Yes	Yes	No	Yes	--	P R T A	Yes
3. Calif.	Yes	No	No	No	No	- - T -	Yes
4. Calif.	Yes	--	--	--	--	- - - - -	No
5. Conn.	Yes	Yes	No	--	--	P - T -	Yes[b]
6. Fla.	Yes	--	Yes	Yes	--	P R T -	Yes
7. Ill.	Yes	--	--	--	--	P R T A	Yes[b]
8. Ind.	Yes	--	--	--	--	- - - A	Yes
9. Ind.	Yes	No	No	--	--	P R T -	Yes
10. Iowa	Yes	Yes	Yes	Yes	Yes	P R T A	Yes[b]
11. Kans.	Yes	Yes	Yes	--	Yes	P R T A	Yes[b]
12. Ky.	Yes	Yes	Yes	--	--	P - - A	Yes[b]
13. Me.[c]	--	--	--	--	--	- - - -	--
14. Md.	Yes	Yes	Yes	--	--	P - T A	Yes[b]
15. Mass.	Yes	Yes	Yes	--	--	P R T A	Yes
16. Mass.	Yes	Yes	Yes	--	--	P R T A	Yes
17. Minn.	Yes	Yes	Yes	--	Yes	P R T -	Yes[b]
18. Miss.	Yes	Yes	Yes	Yes	Yes	P R T A	Yes
19. Mo.	Yes	Yes	Yes	Yes	--	P R T A	Yes
20. Mont.	Yes	No	No	--	No	P - T A	Yes
21. N.H.	Yes	Yes	Yes	Yes	Yes	P R T A	Yes
22. N.J.	Yes	Yes	Yes	--	--	P R T A	Yes[b]
23. N.Y.	Yes	Yes	--	--	--	P R T A	Yes[b]
24. N.Y.	Yes	Yes	Yes	--	--	P R T A	Yes
25. N.Y.	Yes	--	--	--	--	P R T A	Yes
26. N.C.	Yes	--	--	--	--	P R T A	Yes
27. N.D.	Yes	Yes	Yes	--	Yes	P R T A	Yes
28. Ohio	Yes	No	Yes	--	--	P R T A	Yes
29. Ohio	Yes	Yes	No	--	--	P R T -	Yes
30. Okla.	Yes	Yes	--	Yes	--	P - - -	--
31. Oreg.	Yes	--	--	--	--	- - T -	Yes
32 Pa.	Yes	Yes	Yes	--	--	P R T A	Yes
33. R.I.	Yes	--	--	--	--	P R T A	Yes
34 Tenn.	Yes	Yes	--	Yes	--	- - - -	Yes[b]
35. S.C.	--	--	--	--	--	- - - -	--
36. S.C.	Yes	--	--	--	--	P - T -	--
37. S.C.	Yes	--	--	--	--	- R T -	--
38. S.D.	Yes	--	Yes	--	Yes	P R T A	Yes
39. Vt.	Yes	Yes	--	--	--	P - T A	Yes
40. Va.	Yes	--	--	--	--	- - - A	Yes[b]

(Table concluded on following page)

Table 76 (concluded)

Report from:	Opinion regarding different questions						
	Is pre-treatment desirable?					Amount of publicity	Inform victory gardeners
	Vegetable	Cereal	Corn	Cotton	Flax		
Question	(A)	(B)	(C)	(D)	(E)	(F)	(G)
41. Va.	Yes	Yes	Yes	Yes	--	P - T A	Yes
42. Wash.	Yes	Yes	--	--	--	- R T -	Yes[b]
43. W.Va.	Yes	Yes	Yes	--	--	P R T A	Yes
44. Wis.	Yes	Yes	Yes	--	Yes	P R T A	Yes
45. USDA	Yes	Yes	Yes	Yes	Yes	P R T A	Yes
46. USDA	Yes	--	--	--	--	- - - -	Yes
47. USDA	Yes	--	--	--	--	- - T A	Yes

[a] Amount of publicity: P -- prepare press releases; R -- deliver radio talks; T -- personal appearance before grower groups; A -- write articles for extension release, bulletins, and journals.

[b] Would delegate authority to a colleague within the State.

[c] Data for State on seed treatments not yet completed

An examination of the tabulated information shows unanimous agreement on the need of seed treatment for most of the crops with which these workers are familiar. They believe emphatically that the seedsmen would be performing a commendable public service by treating seed before it is packaged. They are willing to support the seedsmen who participate by publicizing the merits of treated seed. Most of them would even go so far as securing petitions for pre-treated seed from victory gardeners to reassure seedsmen if the latter required additional evidence of their support and also of the practical advantages of supplying treated seed to the home gardener.

From miscellaneous comments returned with the questionnaire it is obvious that very few, if any, of the State authorities wish to high-pressure the seed producers and retailers into treating seed against their will. The unanimous sentiment seems to be that plant pathologists should assist, cooperate with, and advise all seedsmen, and assure them of active support for those who find it possible to treat seed for their customers. Most pathologists feel that under the terms of such a cooperative effort, a program of pre-treating all packet vegetable seed will flourish and eventually become a standard practice among seedsmen.

D. A Set of Standard Recommendations for 1944

The cooperative seed treatment tests of 1940, 1941, and 1942 had provided abundant sound data; therefore it was possible to pick out certain treatments for various vegetables that seemed universally effective. On the basis of this information the workers listed in the preceding section were asked for their opinions regarding the following recommendations for their states:

Lima beans treated with Spergon at .20% by weight (2 oz. per bu.)
Beets with cuprous oxide at 1.5% by weight.
Sweet corn with Semesan Jr. at .17% (1.5 oz. per bu.)
Peas with Spergon at .17% (1.5 oz. per bu.)
Spinach with either zinc oxide or cuprous oxide at 1.5%

The replies to these suggestions have been condensed in Table 77:

Table 77. Opinion of cooperators in different States regarding the proposed uniform seed treatment recommendations.

Report from:	Acceptance of proposed treatment				
	Lima bean	Beet	Sweet corn	Peas	Spinach
1. Ariz.	Yes	--	--	--	--
2. Ark.	Yes	--	No	Yes	Yes
3. Calif.	Yes	Yes	Yes	Yes	Yes
4. Calif.	Yes	Yes	Yes	Yes	Yes
5. Conn.	Yes	Yes	Yes	Yes	Yes
6. Fla.	Yes	--	Yes	Yes	Yes
7. Ill.	Yes	Yes	Yes	Yes	Yes
8. Ind.	Yes	Yes	Yes	Yes	Yes
9. Ind.	Yes	Yes	Yes	Yes	Yes
10. Iowa	Yes	Yes	Yes	Yes	Yes
11. Kans.	Yes	Yes	Yes	Yes	Yes
12. Ky.	Yes	Yes	Yes	Yes	Yes
13. Maine	--	--	--	--	--
14. Md.	Yes	Yes	Yes	Yes	Yes
15. Mass.	Yes	Yes	Yes	Yes	Yes
16. Mass.	Yes	--	Yes	--	Yes
17. Minn.	Yes	Yes	Yes	Yes	Yes
18. Miss.	Yes	Yes	Yes	Yes	Yes
19. Mo.	Yes	Yes	No	Yes	Yes
20. Mont.	--	Yes	Yes	Yes	--
21. N.H.	Yes	Yes	Yes	Yes	Yes
22. N.J.	Yes	Yes	Yes	Yes	Yes
23. N.Y.	Yes	Yes	Yes	Yes	Yes
24. N.Y.	Yes	Yes	Yes	Yes	Yes
25. N.Y.	Yes	Yes	No	Yes	Yes
26. N.C.	Yes	Yes	Yes	Yes	Yes
27. N.D.	Yes	Yes	Yes	Yes	Yes
28. Ohio	Yes	Yes	Yes	Yes	Yes
29. Ohio	Yes	Yes	Yes	Yes	Yes
30. Okla.	Yes	Yes	--	Yes	Yes
31. Oreg.	Yes	Yes	Yes	Yes	Yes
32. Pa.	Yes	Yes	Yes	Yes	Yes
33. R.I.	--	Yes	--	--	Yes
34. Tenn.	Yes	Yes	Yes	Yes	Yes
35. S.C.	Yes	Yes	Yes	Yes	Yes

(Table concluded on next page)

Table 77 (concluded)

Report from:	Acceptance of proposed treatment				
	Lima bean	Beet	Sweet Corn	Peas	Spinach
36. S.C.	Yes	Yes	Yes	Yes	Yes
37. S.C.	Yes	Yes	Yes	Yes	Yes
38. S.D.	Yes	Yes	Yes	Yes	Yes
39. Vt.	Yes	Yes	Yes	Yes	Yes
40. Va.	--	Yes	--	Yes	Yes
41. Va.	Yes	Yes	Yes	Yes	Yes
42. Wash.	Yes	Yes	Yes	Yes	Yes
43. W.Va.	Yes	Yes	Yes	Yes	Yes
44. Wis.	Yes	Yes	Yes	Yes	Yes
45. USDA	Yes	Yes	Yes	Yes	Yes
46. USDA	Yes	Yes	Yes	Yes	Yes
47. USDA	--	--	--	--	--

a Treatment all right but not needed in this State

The cooperators who responded to the questionnaire were in surprisingly close agreement with the suggestions. Although several of them expressed a desire to name alternate treatments for their States, they were practically unanimous in endorsing the suggested treatments as being highly effective for their area. This compilation should settle once and for all the question of whether plant pathologists can agree on a set of treatments. The seedsmen who deal in interstate business can rest assured that seed treated with these particular materials will be endorsed by competent authorities in the areas where they are to be sold.

The compilation in Table 77 must not be construed as the preferred treatment in all of the States. Several authorities believe other materials to be equal to these or even slightly superior for these plants for their particular localities. Furthermore, these standards may be changed from year to year as adequate experience is obtained with other treatments. Undoubtedly, there would be considerable sentiment for the use of Arasan on spinach and sweet corn in view of its excellent performance in the 1943 cooperative tests reported in other articles of this series.

E. What Treatments Are Being Recommended in Different States?

In order to secure some indication of the preferred treatments in different States, the cooperators were asked to nominate their first, second, and third choices for all vegetable crop seeds and the preferred dosages. These data have been summarized and are on file with the committee chairman.

F. Postal Regulations Affecting Shipment of Treated Seed through the Mails

Although several seed dealers have been distributing treated seed through the mails for several years, some retailers expressed concern that they would run afoul of postal regulations if they inaugurated a program of pre-treating vegetable seed. The committee, therefore, devoted considerable study to the existing regulations and conferred with the proper au-

thorities regarding certain changes that seemed desirable. It may be worth while to summarize the results of these investigations, in order to clear up certain misconceptions prevalent among both plant pathologists and seedsmen.

The following postal regulations were found to be in effect on May 27, 1943:

1. Treated seed are admissible to the mails.
2. No specific regulations on the shipment of treated seed have been in force.
3. The rigid regulations controlling the shipment of fungicides could be invoked against seed that carried these fungicides. The Postal Laws and Regulations specify that cartons of fungicides must be marked "Poisonous Composition" and bear the manufacturer's label (Section 588, paragraph 4b). The fungicide must be enclosed in an inside container of metal, glass, or fiber, and these, in turn, must be packed inside a box with ample cushioning material to prevent breakage and in the case of liquids to absorb the fungicide should inside container be broken (Section 590, paragraph 4f).

Since it was obvious that these restrictions on packages would cause seedsmen considerable difficulty if they were applied to treated seed, the Committee conferred with Mr. J. D. Hardy, General Superintendent of the Division of Railway Mail Service, Post Office Department, regarding a more practical arrangement. Mr. Hardy suggested that sealed envelopes or packets should first be placed in a cardboard box or boxes and then in a fiber mailing box before they would be acceptable for mailing. He did not consider it desirable to have the envelopes loose in the outside container.

It is obvious that even this lenient requirement would entail extra packages and labor, and would work a hardship on seedsmen. This ruling was considered unduly strict because 99.8% of the packet consists of seed and the 0.2% of fungicide is so firmly attached to the seed that there is practically no chance for it to escape into the mail and create a nuisance. After considering these extenuating circumstances, Mr. Hardy accepted our suggestion for admitting the regular packets as long as they are protected by a second covering. In a letter to the writer, dated July 27, 1943, he specified,

"Seeds treated with a fungicide will be accepted for transmission in the mails when inclosed in two strong envelopes, the inside envelope to contain the seed. In no case should the envelope bulge from too many seed inclosed."

This final ruling would appear to be very reasonable and broad-minded. It specifically exempts treated seed from the rigid rules governing shipment of fungicides in bulk. It places considerable responsibility on the seedsmen, but it will not cause them any particular difficulty since the standard packages now used by most companies will be acceptable. The seed distributors will have to take precautions to be certain that:

1. All packets and boxes have the flaps completely and firmly sealed.
2. Envelopes are not overloaded so as to create excessive internal pressure.
3. Single envelopes or packets are enclosed in a strong envelope before mailing.
4. Orders involving several packets are enclosed in strong envelopes or preferably in strong cardboard or fiber boxes that will prevent crushing from external pressure.

The Committee trusts that these facts will be of interest to seed distributors and will encourage them to go ahead in treating seed that will later be transmitted through the mails. The Committee also feels that a word of commendation of the Post Office Department's cooperative attitude and very courteous handling of this matter is fully warranted.

A memorandum covering the facts outlined above, and in the same wording, was submitted to Mr. Hardy on August 4 and was approved for publication by him in a letter to the writer on August 18 (filed in their correspondence under code RyHs-H).

G. Summary of Status of Project on Pre-Treatment of Vegetable Seed

The data obtained to date and presented in this report show that there are practically no technical obstacles in the way of the program for pretreatment of vegetable seed. There are several good treatments for each crop and most of these seem to be universally effective. It is possible to pick from among these at least one for each crop that is relatively non-toxic to human beings. The plant pathologists have agreed upon a uniform set of treatments for the principal vegetables, but details must still be worked out regarding minor crops and certain seed disinfectants. Of the standard treatments adopted to date only one (on sweet corn) is a violent poison and this material undoubtedly could be replaced safely by less toxic materials such as Arasan or Spergon.

The seedsman who deals in interstate business needs to use only one treatment on a given crop. In case he is interested in preferred treatments for any locality in the United States, he can obtain information from this committee as to whether it differs from the standards. Those seedsmen who follow these recommendations can expect reasonable support and active promotion from plant pathologists. The postal regulations have been modified so that seedsmen will not have to alter their mailing packages or go to appreciable extra distribution costs if they treat the seed before distribution.

As a matter of fact, about the only concrete arguments still standing against inaugurating the program are the mechanical difficulties involved. There is no question that the seedsmen will find it difficult at this time to secure additional equipment and labor for this added service and supplies of some chemicals will be inadequate. In spite of all this, however, at least one major seed house operating throughout the nation has inaugurated a comprehensive program and several others have indicated

an interest in inaugurating a modest program.

The plant pathologists are under an obligation to push their publicity program on seed treatments. They must educate the growers as to the value of seed treatments and the advantage of securing pre-treated seed wherever they are available. Efforts must be continued to keep the list of approved treatments up to date.

NAUGATUCK CHEMICAL DIVISION OF UNTIED STATES RUBBER COMPANY, NAUGATUCK, CONN (Formerly at New York State Agricultural Experiment Station, Geneva)

XVII. COOPERATION OF SEEDSMEN IN TREATING SEED BEFORE DISTRIBUTION

Willard Crosier and R. H. Porter

Contacts were made during 1943 with various seed trade groups in order to further the seed-treatment program. It was considered necessary for the plant pathologists to obtain information on the status of seed-treatment practices in various seed companies before offering their services or suggesting any changes. Undoubtedly any sudden expansion of seed treatments would create certain problems for seedsmen, official analysts, and related agencies; therefore, circular letters and questionnaires as well as personal contacts were employed in exchanging information.

The seedsmen expressed considerable interest in the project and were fully cooperative. In addition to supplying information about their trade practices, several of them submitted samples of pea, spinach, and lima bean stocks for tests. The information obtained from the seedsmen and these cooperative tests are briefly summarized in this report.

Seedsmen's Opinion Regarding Treatment of Seed Before Distribution

Questionnaires were mailed to many of the seed houses throughout the United States shortly after the authors joined the committee in March, 1943. The answers received and results of a similar survey made by the junior author in 1942 showed that the seedsmen were fully aware of the advantages of seed treatment and were treating seed for their own foundation stocks and for their customers. Many were hesitant, however, about initiating a seed treatment program because of labor and material shortages, lack of demand, and the health hazards involved. The seed treatments used were those recommended by State experiment stations and the U. S. Department of Agriculture.

Most of the seed companies gave an affirmative answer to the question "Would you be willing to treat your packeted seed if you were convinced it was of value to you?" All those replying to the questionnaire requested additional information on the subject of seed treatments, and many of them pointed out the special problems that would confront them. Typical comments were as follows:

1. "We have well recognized the value of certain seed protectants and have used them over a period of years", but . . . "there is the matter of securing sufficient quantities of seed protectants to treat even a small portion of the total amount of vegetable seeds."

2. "At present the drawbacks are time, danger of mixtures, and discomfort to employees in packaging."

3. "It would probably be impossible to treat all seeds sold on account of scarcity of labor and materials. For some vegetable seeds we are not sure about the proper material to use, and in these cases we simply have treated seed only on the customer's request."

Current Seed Treatment Practices

Several companies provided information on the extent to which they use seed treatments. Practically all of those who produced seed or maintained foundation stock used treated seed in their own plots. The program for treating their customers' seeds varied widely. Only one company treated all seed of the 7 vegetables specifically mentioned in the questionnaire. Several others, however, were willing to treat the seed upon request. The records on 5 companies that were kind enough to supply complete information have been summarized in Table 78.

Table 78. Types of seed treatments used by different seed companies on 7 vegetable crops.

Kind of seed treated	Protectant used by[a]					Extent of treating by				
	I	II	III	IV	V	I	II	III	IV	V
Beets	CO[b]	ZO	CO	CO	CO	[c]AC	AC	R	T	P
Cucumbers	CO	ZO	Hg	CO/Hg	--	AC	AC	R	T	--
Lima beans	Sp	--	Sp	Sp	Sp	AC	--	R	T	P
Melons	CO/Hg	ZO/Hg	Sp/Hg	CO/Hg	--	AC	AC	R	T	--
Peas	Sp	Sp	Sp	Sp	S, A	AC	AC	R	T	AC
Spinach	ZO	ZO	CO	CO,ZO	CO	AC	AC	R	T	P
Sweet corn	Sp	--	Sp, SJ	SJ	SJ	AC	--	R	T	P

[a] The seedsmen contributing to this report are: I, Eastern States Farmers' Exchange; II, Southern States Coop., Inc.; III, Associated Seed Growers, Inc.; IV, Ferry-Morse Seed Co.; and V, Robson Seed Farms.

[b] The symbols used are as follows: A, Arasan; CO, red copper oxide; Hg, mercuric chloride; S, Semesan; SJ, Semesan Jr.; Sp, Spergon; and ZO, zinc oxide.

[c] The symbols used are as follows: AC, for all customers; P for part of customers; R, upon request only; and T, for trial and foundation stocks only.

It is of interest to note that spinach and pea seed are being treated more estensively than that of the other crops. This undoubtedly is due to the greater susceptibility of these seed to decay and of the seedlings to damping-off. Most of the treatments being used are primarily seed protectants. However, in the case of melons and cucurbits, the bichloride of mercury dip is commonly used as a disinfectant prior to the application of a protectant.

Results of Trials with Typical Seedstocks

Since it has been shown that different seed stocks, even within the same variety, differ widely in their responses to seed treatment, several growers were invited to submit stock typical of those used for the packet trade. It was hoped that records would be obtained on a typical cross section of the seed being used by the trade and at the same time interest would be aroused in seed treatments among any critical seedsmen who were skeptical of its value.

Several stocks of peas, lima beans, and spinach were treated with different materials and planted in a series of tests under different conditions in New York and Iowa. The treatments applied were: to peas, Arasan at 0.12% and Spergon at 0.21%; to lima beans, Arasan at 0.12%, Spergon at 0.21%, and Fermate at 0.21%; and to spinach, Arasan at 0.5%, Spergon at 1.0%, and zinc oxide at 1.0%. The results from several tests made in New York State are summarized in Table 79. The treatments were decidedly beneficial in nearly all tests. Even the starchy-seeded Alaska variety of peas that is not very susceptible to seed decay gave substantially better emergence when treated.

Table 79. Effectiveness of seed treatments in improving the emergence of different seed stocks under New York conditions.

Variety of seed	Where planted	Emergence from seeds treated with			
		Check	Arasan	Spergon	Fermate
Peas					
Thomas Laxton	Field	25	44	47	--
Thomas Laxton	Greenhouse	38	86	86	--
Alaska	Field	63	--	73	--
Little Marvel	Field	64	--	73	--
Worlds Record	Field	49	--	64	--
Wisconsin Perfection	Field	31	--	55	--
Lima beans					
Fordhook	Field	11	15	19	9
Fordhook	Greenhouse	18	67	60	59
Henderson Bush	Field	4	--	28	--
Burpee's Bush	Field	8	--	23	--
Burpee's Large White	Field	5	--	14	--
Emerald Bush	Field	2	--	17	--
Spinach					
Viking	Field	25	32	36	35
Viking	Greenhouse	46	62	48	56
King of Denmark	Field	11	--	--	23
L. S. Bloomsdale	Field	28	30	--	39
L. S. Bloomsdale	Greenhouse	62	71	--	67
King of Denmark	Field	10	13	--	16
King of Denmark	Greenhouse	47	55	--	54

A similar series of tests was made with some of the same seed lots under Iowa conditions. Emergence records are given in Table 80. Although better conditions prevailed for seed germination, all lots of spinach benefited from treatment and there was a slight improvement in the peas. No lima beans were tested in Iowa.

Table 80. Effect of seed treatments on emergence of seed sown under Iowa conditions.

Seed treated		Percentage of emergence			
Crop	Variety	Check	Arasan	Spergon	Zinc oxide
Peas	Thomas Laxton	87.0	94.6	89.4	---
Spinach	Viking	51.2	57.4	56.0	64.6
Spinach	L. S. Bloomsdale	54.8	69.6	---	67.6
Spinach	King of Denmark	36.8	44.0	---	44.4

Support from Special Groups

In addition to correspondence with seed companies, personal contacts were made by plant pathologists in different sections of the country. Some of the following observations further emphasize the growing interest of seedsmen in seed treatments.

Dr. L. D. Leach of Davis, California, reported on interviews held with seedsmen at the Pacific States Seedsmen's Association meeting in June 1943. He found seedsmen interested, some practicing treatment, and some feeling that a program of the kind advocated is inevitable. He recommended that our program for the first year be limited to a few crops which are quite susceptible to damping-off and that the chemicals employed should be absolutely safe to both the crop and to human beings.

Dr. A. N. Brooks of Florida was invited to speak before the Florida Seedsmen's Association and received offers of their cooperation in the program of seed treatment. Later he and Dr. W. B. Tisdale provided a mimeographed circular to assist those interested in the project.

The senior author prepared an article that was published in the Seed World. Mr. Helgoson, the editor, has indicated his whole-hearted cooperation in the project of improving the performance of seed stocks. Similar favorable publicity for pre-treatment was obtained in an article by P. W. Dempsey published in The Flower Grower

The junior author spoke before the newly organized vegetable seed producers group of the American Seed Trade Association in June 1943, and presented data on the treatment of peas, spinach, onions, and other vegetable crops obtained in a special laboratory method using Pythium-infested soil. The interest of those who attended the meeting indicated that seedsmen will cooperate in so far as they consider it safe and practical.

In order to prevent any misunderstanding with persons interested in seed analysis, Mr. C. A. Stahl, president of the Association of Official Seed Analysts, was consulted about the program for encouraging pre-treatment of packeted seed. The widespread application of fungicides might present certain problems of health to the analysts and require revisions in methods of testing viability. Mr. Stahl was of the opinion that there would be no serious objection to testing treated seed provided non-poisonous materials were used.

Postal and Labeling Regulations

Both Mr. Stahl, and Mr. W. A. Davidson, of the Grain and Feed Division, U. S. Department of Agriculture, were of the opinion that postal regulations should be sufficiently lenient to permit distribution of treated seed, and the latter cooperated with the Committee in contacting the postal authorities on the subject. The postal authorities have agreed to a simple, safe package for treated seed, as reported in the preceding article of this series.

The "rules and regulations" of the Secretary of Agriculture for the enforcement of the "Federal Seed Act of August 9, 1939" contain no mention of the labeling requirements for chemically treated seed. Likewise, the suggested "Uniform State Seed Law of June 12, 1940" does not cover the necessary labeling for treated seeds. The United States Pure Food and Drug Administration requires, however, that seed treated with poisonous materials should be labeled. Seedsmen now mark plainly all containers of treated seed with "Poison", "Treated Seeds", "Treated with Semesan", or similar designations. In order to remove the possible sales resistance to packets marked "Poison" and to protect children and small animals, it is advisable that vegetable seeds be treated with a non-poisonous material. The simple statement "Treated Seeds" would then suffice and should provide an incentive rather than an obstacle to buying.

Summary

There seem to be very few difficulties in the way of developing a general program of treating seed before distribution, aside from the difficulties seedsmen will experience in securing labor and equipment. All of the more progressive seed houses are fully aware of the benefits to be obtained from use of seed treatments. Most of them realize that even the best quality seed may be protected from disease organisms so that it will give better performance by treatment. They are perfectly willing to treat seed for their customers as soon as supplies of fungicides become available.

The years immediately ahead may be an opportune time to promote general use of seed treatments in spite of the physical obstacles to be overcome. The American seedsmen will be confronted with a serious problem in supplying the phenomenally heavy demands during 1944. The commercial pack will be 5 to 10% less than that of last year, and the demand greater. In addition to the increased domestic demand, large quantities of seed must be supplied to England and to the liberated areas of Russia, Italy, and Africa. The seedsmen are anxious to meet these unprecedented demands by making more effective use of stocks by such practices as seed treatment that would permit lighter seeding rates. The extent of domestic consumption alone is scarcely realized by the average person. For example, about 18,000,000 packets of vegetable seed were vended in New York State alone during 1943.

There seem to be no serious legal restrictions on the treatment of packet seed, and the seed analysts apparently have no objection to the seed treatment program. A serious effort should be made to develop non-poisonous treatments for use on vegetable seed. This has largely been accomplished by the discovery of the effectiveness of Spergon, Arasan, and zinc oxide.

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